



NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Earth System Research Laboratory
Physical Sciences Division



Science Review
12-14 May 2015
Boulder, CO

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Overview

Welcome to the NOAA Earth System Laboratory Physical Sciences Division 2015 Science Review. The information contained in this document is also available on our website at:

<http://www.esrl.noaa.gov/psd/events/2015/review/>

Review Themes

THEME I: OBSERVING THE PHYSICAL SYSTEM

Observations are critical for monitoring, analyzing, interpreting and predicting atmospheric, oceanic, cryospheric, and land surface processes. NOAA's Physical Sciences Division (PSD) has expertise in the design, testing, deployment, and maintenance of in situ and remote sensing observing systems that advance an observation-based process understanding of current environmental conditions, how these conditions may be changing, and why. PSD collects research-quality observations of key environmental data that provide critical information on boundary and surface layer fluxes between and among the atmosphere, ocean, sea-ice, and land. PSD makes strategic use of observations to advance scientific understanding of physical processes controlling high-impact extreme weather and climate events that include flux measurements in tropical cyclones and vertical profiles of atmospheric systems for nowcasting the intensity and duration of extreme precipitation. Advances in PSD's observation-based scientific understanding are used to guide development of physical process-based parameterizations that can improve the skill and reliability of global and regional forecast models.

PSD observations of key parameters range from the microscale to the synoptic scale, and include air-sea/ice/land fluxes, cloud and sea-spray microphysical properties, surface and cloud radiation, tropospheric winds, precipitation processes, soil moisture, and aerosols. PSD observations span the globe including the Arctic, the Tropical Western Pacific and the Western U.S. PSD's engineering expertise has made it possible to obtain these kinds of measurements from land-based sites, research aircraft, and research vessels at sea. Ship-borne observing systems have been used to investigate air-sea transfer processes in the tropical ocean to better understand and to improve parameterization of these interactions in climate models. Long-term Arctic atmospheric observatories have been established to better monitor and understand changing conditions in the Arctic. PSD advances observing technologies including the development and deployment of a novel radar system for measuring the ocean's sea spray layer from aircraft. PSD operates a fast deployable wind/precipitation profiler and surface meteorological network that is currently deployed across California and the Pacific Northwest to support the monitoring and improved prediction of heavy precipitation events, to help address associated flooding and water resource management challenges, and to improve wind energy resource forecasts as part of a Wind Forecast Improvement Project. PSD has developed unique cloud and precipitation profiling radars that have allowed new findings about the structure and evolution of precipitating cloud systems. PSD also develops new observation techniques based on using electromagnetic signals of opportunity such as Global Navigation Satellite System that have the potential to provide inexpensive measurement of soil, snow, ice, and vegetation parameters over the land and sea-state and wind over the ocean.

THEME II: UNDERSTANDING THE PHYSICAL SYSTEM

An integrated understanding of Earth system processes spanning weather and climate timescales is essential to improve the quality of environmental intelligence NOAA delivers to the nation. PSD research describes, interprets, and assesses the predictability of weather, climate, and water variations and trends on time scales ranging from hours to a century. PSD applies innovative diagnostic methods to advance capabilities to detect, understand, explain, and predict extreme events, and trends in the extremes. Understanding how atmosphere, ocean, land, and cryospheric conditions are currently being impacted and may be affected in a changing climate not only provides early warning and informs preparedness, but also identifies prospects for improved forecasts and projections. PSD's efforts to improve current knowledge of the water cycle will advance capabilities to fully understand the linkages between weather, climate, and water. The collective understanding from PSD research provides the foundation to create effective and credible scientific knowledge that is needed to inform policy, planning, and decision making in the management of current and future risks.

Carefully crafted attribution studies carried out by PSD scientists are critical for establishing the principal causes or physical explanation for observed conditions and phenomena. For example, analyses of hydrometeorological measurements made by PSD scientists have increased the capability to more accurately measure and predict precipitation, increasing the understanding of the evolution of droughts, floods, and stream flows from the short-term (e.g., extreme precipitation events over hours and days) to the long-term (e.g., estimating streamflow for the Colorado River in the coming years). Observation based studies have determined the presence and importance of super-cooled liquid water in Arctic clouds that have profound impacts on sea-ice extent and seasonal snow extent. Reanalysis datasets and web-based atmospheric and oceanic data visualization and analysis tools, both developed and assessed by PSD scientists, contribute to the investigation and understanding of the physical system, and are a mechanism for PSD science to extend to the broader scientific community.

THEME III: MODELING THE PHYSICAL SYSTEM

Observations and physical process understanding are transformed into predictive capabilities through numerical modeling. PSD develops and applies data assimilation systems that couple atmospheric, oceanic, and land data in global and regional earth system modeling to advance analysis, forecast, and prediction capabilities. PSD advances the scientific basis to provide early warning and inform preparedness across weather and climate time scales through efforts to improve global and regional forecast and prediction modeling systems. Approaches such as development of new parameterizations as well as pre- and post- processing are applied in global and regional forecast and prediction modeling systems to advance forecast and prediction capabilities. Collectively, PSD's assimilation, development, analysis, and modeling research are critical to meet NOAA's mission responsibilities to understand and predict changes in climate, weather, oceans, and coasts, and to share that knowledge and information with others.

PSD continues its long-term relationship with the NOAA National Centers for Environmental Prediction to improve forecasts. PSD developed, maintains and continues to improve the Ensemble Kalman filter data assimilation system now used operationally for global weather prediction. PSD also developed a set of stochastic parameterizations designed to represent model uncertainty in the operational NCEP global prediction model. In the realm of improved parameterizations, PSD developed an air-sea

coupling module for NCEP's operational hurricane prediction model that includes an advanced sea-spray parameterization scheme to account for the complexity in air-sea interaction under high winds. It also developed a research platform to evaluate the cloud parameterization schemes in NCEP's global and regional prediction models using observations of cloud microphysics properties. Through the NOAA Wind Forecast Improvement Project, PSD is also working with the Department of Energy to improve the skill of NOAA's short-term weather forecast models at predicting foundational weather parameters (for example, wind speed, turbulence intensity, and icing conditions) that impact wind energy generation.

THEME IV: RESEARCH TO APPLICATIONS, OPERATIONS AND SERVICES

The transition of research findings, products and methods into applications, operations and services is fundamental to ensure the best available science is being applied to support NOAA mission responsibilities. To address growing service demands and needs for increased accuracy of weather, climate, and water information, PSD works closely with the NOAA service line offices and external federal, state, and local partners to accelerate the timely transfer of research advances into operational settings and the delivery of information for use in policy, planning, and decision making.

PSD works closely with the NOAA National Weather Service (NWS) to incorporate weather, climate, and water research into operations, including: implementation of testbeds to prototype new observations, models, and algorithms, data assimilation techniques, regional prediction capabilities, air-sea heat flux parameterizations, post-processing forecast tools and techniques, seasonal and subseasonal climate, drought, and hazard outlooks, monitoring analyses, and El Nino Southern Oscillation (ENSO) diagnostic discussions. PSD partners with the NOAA National Marine Fisheries Service (NMFS) to develop actionable information in the form of science-based climate and weather knowledge that has been transformed to be readily understandable and immediately available to support water resource decision making. PSD also collaborates with groups such as: the US Bureau of Reclamation (USBR), the U.S. Agency for International Development (USAID), the U.S. Army Corps of Engineers (USACE), the U.S. Department of Defense (DOD), the U.S. Department of Energy (DOE), the State of California Department of Water Resources (CA-DWR) and Sonoma County Water Agency (SCWA), and the National Integrated Drought Information System (NIDIS) to provide the best available weather, climate, and water science to inform policy and management decisions. PSD leads an international consortium of Arctic Observatories that network to provide detailed pan-Arctic information on the state of the Arctic atmosphere that will inform the WMO Polar Prediction Project. In addition, PSD conducts research on how stakeholders use weather, climate, and water information to assess what is needed for the information to be usable and actionable, thus linking management planning processes and operational issues with potential uses of weather, climate, and water forecasts and information.

**NOAA Office of Oceanic and Atmospheric Research (OAR)
Earth System Research Laboratory (ESRL)
Physical Sciences Division (PSD)
2015 Science Review
May 12–14, 2015
Boulder, CO**

AGENDA

Tuesday, May 12, 2015

PRELIMINARIES

- 07:00 Closed Breakfast – Homewood Suites, Boulder Room (OAR Assistant Administrator & Deputy Assistant Administrator with Review Panel)
- 07:30 Travel to ESRL (Shuttle provided for Review Panel – Other guests should carpool or self-drive)

WELCOMING TALKS (GC402)

- 08:15 Welcome, Introduction of Review Panel – Craig McLean (Assistant Administrator, NOAA/OAR)
- 08:30 NOAA and OAR Research Planning – Steven Fine (Deputy Assistant Administrator, NOAA OAR)
- 08:45 ESRL Overview – Alexander MacDonald (Senior Scientist, NOAA/OAR and Director, OAR/ESRL)
- 09:00 ESRL/PSD Overview – Robert Webb (Director, ESRL/PSD)
- 09:45 **Break and Light Refreshments with Demonstrations (15 min)**
FACTS Data Access and Visualization – Donald Murray
The Climate Change Web Portal – James Scott
PSD Web-Based Visualization and Analysis Tools – Catherine Smith
- 10:00 PSD Strategic Priorities and Review Themes – Randall Dole (Senior Scientist, ESRL/PSD)

THEME 1: OBSERVING THE PHYSICAL SYSTEM (GC402)

- 10:15 Overview: Water Cycle – Allen White
- 10:25 CalWater 2015 – Ryan Spackman
- 10:40 Linking Aerosols and Precipitation – Jessie Creamean
- 10:55 Advances from CALWATER2/VAMOS/DYNAMO Campaigns – Christopher Fairall
- 11:10 Role of gap-filling radars to improve QPE in complex terrain – Robert Cifelli

- 11:25 Measurements of Soil Moisture and Ocean Wind Using GNSS Reflected Signals – Valery Zavorotny
- 11:40 Summary: Water Cycle – Allen White
- 11:45 Discussion
- 12:00 *Closed Lunch (Invitation Only) – Review Panel with Senior OAR HQ Leadership and PSD Director Senior Management (60 min – GB124)*
- 01:00 Overview: Arctic – Taneil Uttal
- 01:10 Unraveling the Secrets of Arctic Clouds – Matthew Shupe
- 01:25 Understanding Atmospheric Forcing of Arctic Sea Ice Through Surface Energy Fluxes – Ola Persson
- 01:40 Arctic Observing: Addressing Current Limitations to Advance Scientific Understanding – Gijs de Boer
- 01:55 Summary: Arctic – Taneil Uttal
- 02:00 Discussion
- 02:15 *Break and Light Refreshments (15 min)*

THEME 2: UNDERSTANDING THE PHYSICAL SYSTEM (GC402)

- 02:30 Overview: Atmosphere and Ocean Dynamics – George Kiladis
- 02:40 Stable Boundary Layers – Andrey Grachev
- 02:55 Impacts of Atmospheric Tropical Waves on Weather and Climate in Observations versus Models – Juliana Dias
- 03:10 Tropical Forecasts and Predictability for Week 3 and Beyond – Matthew Newman
- 03:25 The Processes Underlying the Pacific Decadal Oscillation – Michael Alexander
- 03:40 Summary: Atmosphere and Ocean Dynamics – George Kiladis
- 03:45 Discussion
- 04:00 *Break and Light Refreshments (15 min)*
- 04:15 Overview: Explaining Extremes to Improve Predictions – Joe Barsugli
- 04:25 Understanding and Explaining Causes for Trends in Regional Precipitation – Martin Hoerling
- 04:40 Understanding and Explaining Causes of Weather and Climate Related Extreme Events – Judith Perlwitz
- 04:55 Linkages between ARs and Orographic Precipitation in the Western U.S. – Mimi Hughes

- 05:10 On the Current Role of Climate Change in 2011-2014 California Drought – Linyin Cheng
- 05:25 Summary: Explaining Extremes to Improve Predictions – Joe Barsugli 05:30 Discussion
- 05:45 *Adjourn* 06:00 *Review Panel Closed Session (1D-708)*
- 07:00 *Closed Dinner (Invitation Only) – Review Panel with OAR and PSD Senior Management*

Wednesday, May 13, 2015

PRELIMINARIES

- 07:00 Breakfast at Hotel
- 07:45 Travel to ESRL (Shuttle provided for Review Panel – Other guests carpool or self-drive)

THEME 3: MODELING THE PHYSICAL SYSTEM (GC402)

- 08:15 Overview: Improving Model Processes – Robert Cifelli
- 08:25 Radiative Forcing in CMIP6 – Robert Pincus
- 08:40 Evaluation of Microphysics Schemes for Numerical Weather Prediction – Jian-Wen Bao
- 08:55 Improving Weather and Climate Prediction Models Through the Super-Parameterization Approach – Stefan Tulich
- 09:10 High Resolution Modeling to Understand Flood Risk and Hail Impacts in Future Climates – Kelly Mahoney
- 09:25 Summary: Improving Model Processes – Robert Cifelli
- 09:30 Discussion
- 09:45 *Break and Light Refreshments with Demonstrations Repeated (15 min)*
- 10:00 Overview: Modeling the Climate System – Prashant Sardeshmukh
- 10:10 The Stochastic Framework for Understanding Climate – Cecile Penland
- 10:25 Challenges in modeling extremes – Prashant Sardeshmukh 10:40 Modeling the Arctic System – Amy Solomon
- 10:55 20th Century Reanalysis – Gilbert Compo
- 11:10 Summary: Modeling the Climate System – Prashant Sardeshmukh
- 11:15 Discussion

POSTER SESSION I – 11:30-12:15 (GC402 and ATRIUM)**Reviewers and Visitors Only**

- Impacts of Extratropical-Tropical Interaction on Subseasonal North American Atmospheric Variability – John Albers
- Description and Capabilities of an Automated Objective Technique for Identifying Atmospheric Rivers – Darren Jackson
- Comparison of Simulated Soil Moisture in a Distributed Hydrological Model Using Direct Observations – Robert Zamora
- Development of Calibrated Probabilistic Forecast Products for Extreme Rainfall – Michael Scheurer
- Comparison of Global Precipitation Estimates Across a Range of Temporal and Spatial Scales – Maria Gehne

12:15 *Closed Lunch1 (Invitation Only) – Review Panel with Invited PSD Staff (60 min – GB124)*
Closed Lunch2 (Invitation Only) – Leadership Across NOAA with PSD Research Team Leads and PSD Management (60 min –GC402)

POSTER SESSION II – 01:15-2:00 (GC402 and ATRIUM)**Reviewers and Visitors Only**

- Impact of Climate Variability and Change on Marine Ecosystems – Michael Alexander
- International Arctic Systems for Observing the Atmosphere – Sandra Starkweather
- Stakeholders Interactions to Improve the Use of Climate Information – Andrea Ray
- Using the Absence of Wind-Profiler Reflectivity to Study Stratocumulus-Topped Marine Boundary Layer Processes – Leslie Hartten
- XPIA: Development of Remote Sensing Techniques for Renewable Energy Applications – Katherine McCaffrey
- High resolution ensemble data assimilation for operational hurricane prediction - Henry Winterbottom

THEME 4: RESEARCH TO APPLICATIONS, OPERATIONS AND SERVICES (GC402)

02:15 Overview: Serving Stakeholders – Laura Bianco

02:25 Wind Forecast Improvement Project (WFIP and WFIP2) – James Wilczak

02:40 Improving Seasonal Forecasts to Help with Drought Planning in California – Klaus Wolter

02:55 Developing Data Tools and Products in Support of Research to Applications – Allen White

- 03:10 A “Sea to Summit to Sea” Approach to Improve Management of Water Resources – Lynn Johnson
- 03:25 Summary: Serving Stakeholders – Laura Bianco
- 03:30 Discussion
- 03:45 *Break and Light Refreshments with Subset of Posters Repeated (15 min)*
- 04:00 Overview: Serving NOAA – Thomas Hamill
- 04:10 Ensemble Data Assimilation – Jeffrey Whitaker
- 04:25 Model Uncertainty Parameterization in Ensembles – Philip Pegion
- 04:40 Ensemble Reforecasts and Post-Processing – Thomas Hamill
- 04:55 Air–Sea Flux Products – Christopher Fairall
- 05:10 Summary: Serving NOAA – Thomas Hamill
- 05:25 Discussion
- 05:30 *Adjourn*
- 05:45 *Review Panel Closed Session (1D708)*
- 05:45 *NOAA Line Office, OAR and PSD Senior Management Closed Session (3B207)*
- 07:00 *Dinner – On Your Own (Optional Reservations for 20 at the Boulder Dushanbe Tea House)*

Thursday, May 14, 2015

PRELIMINARIES

- 07:00 Breakfast
- 07:45 Travel to ESRL (Shuttle provided for Review Panel if needed – other guests carpool or self-drive)

STAKEHOLDER SESSIONS

- 08:00 Preparation for Concurrent Closed Sessions with Review Panel

Session 1 (1D708)

- 08:15 Gary Eilerts (Program Manager, Famine Early Warning Systems Network, USAID) – DC
- 08:35 Wayne Higgins (Director, Climate Program Office, NOAA Research) – CO
- 08:55 Levi Brekke (Chief, Research and Development, U.S. Bureau of Reclamation) – CO
- 09:15 John Cortinas (Director, Office of Weather and Air Quality, NOAA Research) – CO
- 09:35 Michael Anderson (State Climatologist, California Department of Water Resources) – CA

Session 2 (1D403)

- 08:15 Hendrik Tolman (Director, Environmental Modeling Center, NOAA National Weather Service) – DC
- 08:35 Joel Cline (Program Manager, Wind and Water Power Program, U.S. Department of Energy) – DC
- 08:55 Von Walden (Professor, Department of Civil Engineering, Washington State University) – WA
- 09:15 Tony Willardson (Executive Director, Western States Water Council) – UT
- 09:35 Roger Pulwarty (Director, National Integrated Drought Information Service) – CO

REVIEW PANEL SUMMARY, WRAP-UP AND DISCUSSION (1D708)

- 10:00 OAR and PSD Senior Management with Review Panel

REVIEW PANEL CLOSED SESSION (1D708)

- 10:30 Discussion and Report Coordination

REVIEW PANEL PRELIMINARY REPORT-OUT (1D708)

- 12:00 OAR and PSD Senior Management with Review Panel
- 01:00 *Adjourn*

A. Presentations and Posters



**ESRL Physical Sciences Division
Science Review
May 12-14, 2015**

B. Staffing and Budget



**ESRL Physical Sciences Division
Science Review
May 12-14, 2015**

PSD Staffing

Director's Office

Director	Robert	Webb
Deputy Director	Brian	Gorton
Senior Scientist	Randall	Dole
Research Council Chair	Richard	Lataitis

Budget and Administrative Group		
Admin Officer	Brian	Gorton
Admin Specialist	Rita	Lombardi
Admin Specialist	William	Otto
Budget Analyst (Sr.)	Tina	Schiffbauer
Budget Analyst	Holly	Rosales
Budget Analyst	Frances	Snow
Secretary	Shawn	Dowd
Secretary	Madeline	Sturgill

Communications Group		
Communication Coordinator	Barb	DeLuisi

Information Technology Group		
Sr. IT Manager	Nick	Wilde
IT Security	Eric	Estes
IT Specialist	Sandra	Lubker
Sys. Admin. Team Lead	Rusty	Jesse
	Kelly	Healy
	Alex	McColl
	Barry	McInnis
	Dan	Miller
	Ed	Warnken
Web and Data Team Lead	Cathy	Smith
	Don	Hooper
	Chris	Kreutzer

Research Teams

	Atmosphere-Ocean Processes		Attribution and Predictability Assessments	
NOAA Lead	Michael	Alexander	Judith	Perlwitz
CIRES Lead	Juliana	Dias	Joseph	Barsugli
	John	Albers	David	Allured
	Maria	Gehne	Linyin	Cheng
	Alejandro	Jaramillo	Henry	Diaz
	George	Kiladis	Jon	Eischeid
	Roland	Madden	Martin	Hoerling
	Matthew	Newman	Srijita	Jana
	Emily	Riley	Brant	Liebmann
	James	Scott	Ben	Livneh
	Dustin	Swales	Don	Murray
	Stefan	Tulich	Xiao-Wei	Quan
	Giuliana	Turi	Imtiaz	Rangwala
	Yan	Wang	Andrea	Ray
			Lesley	Smith
			De-Zheng	Sun
			Lantao	Sun
			Klaus	Wolter
			Taiyi	Xu
			Heather	Yocum
			Tao	Zhang

	Boundary Layer Observations and Processes Team		Dynamics and Multiscale Interactions	
NOAA Lead	Christopher	Fairall	Alexander	Voronovich
CIRES Lead	Laura	Bianco	Gilbert	Compo
	Ludovic	Bariteau	Antonietta	Capotondi
	Bruce	Bartram	Leslie	Hartten
	Byron	Blomquist	Chesley	McColl
	Irina	Djalalova	Vladimir	Ostashev
	Andrey	Grachev	Cecile	Penland
	Katherine	McCaffrey	Prashant	Sardeshmukh
	Kenneth	Moran	Edward	Walsh
	Sergio	Pezoa	Valery	Zavorotny
	James	Wilczak		
	Daniel	Wolfe		

	Hydrometeorology Modeling and Applications Team		Forecast Modeling and Development	
NOAA Lead	Robert	Cifelli	Jeffrey	Whitaker
CIRES Lead	Kelly	Mahoney	Robert	Pincus
	Coy	Chanders	Jian-Wen	Bao
	Samm	Elliott	Gary	Bates
	Mike	Hobbins	Joseph	Cione
	Chengmin	Hsu	Evelyn	Grell
	Mimi	Hughes	Thomas	Hamill
	Lynn	Johnson	Lili	Lei
	David	Kingsmill	Sara	Michelson
	Sergey	Matrosov	Philip	Pegion
	Michael	Mueller	Michael	Scheuerer
	David	Reynolds	Henry	Winterbottom
	Ellen	Sukovich		
	Christopher	Williams		
	Delbert	Willie		
	Robert	Zamora		

	Hydrometeorology Observations and Processes Team		Polar Observations and Processes Team	
NOAA Lead	Allen	White	Taneil	Uttal
CIRES Lead	Darren	Jackson	Matthew	Shupe
	Scott	Abbott	Robert	Albee
	Joshua	Aikins	Christopher	Cox
	Thomas	Ayers	Sara	Crepinsek
	David	Carter	Gijs	de Boer
	Tim	Coleman	Duane	Hazen
	David	Costa	Janet	Intrieri
	Jessie	Creamean	Elena	Konopleva
	Lisa	Darby	Nathaniel	Miller
	Natalie	Gaggini	William	Neff
	Daniel	Gottas	Ola	Persson
	Paul	Johnston	Amy	Solomon
	James	Jordan	Sandy	Starkweather
	Clark	King	Michael	Stone
	Jesse	Leach		
	Paul	Neiman		
	Ryan	Spackman		
	Raul	Valenzuela		
	Gary	Wick		

Research Partnership Programs

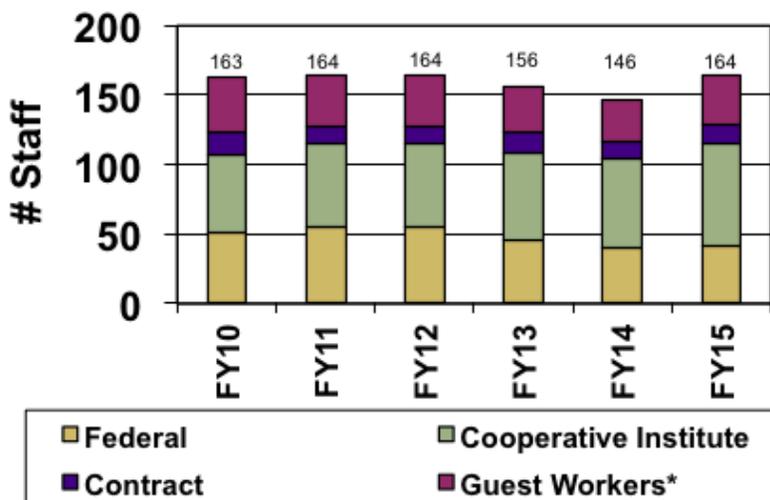
National Integrated Drought Information System	
Kathleen	Bogan
Veva	Deheza
Alicia	Marrs
Roger	Pulwarty
James	Verdin

CU Center for Environmental Technology	
Albin	Gasiewski
Nikolay	Zabotin

Advanced Systems Group	
Dave	Allocca
Alfred	Bedard
Mikhail	Charnotskii
Iosif	Fuks
Oleg	Godin
Reginald	Hill
Vladimir	Irisov
Sandra	McClellan
Konstantin	Naugolnykh
Lev	Ostrovsky

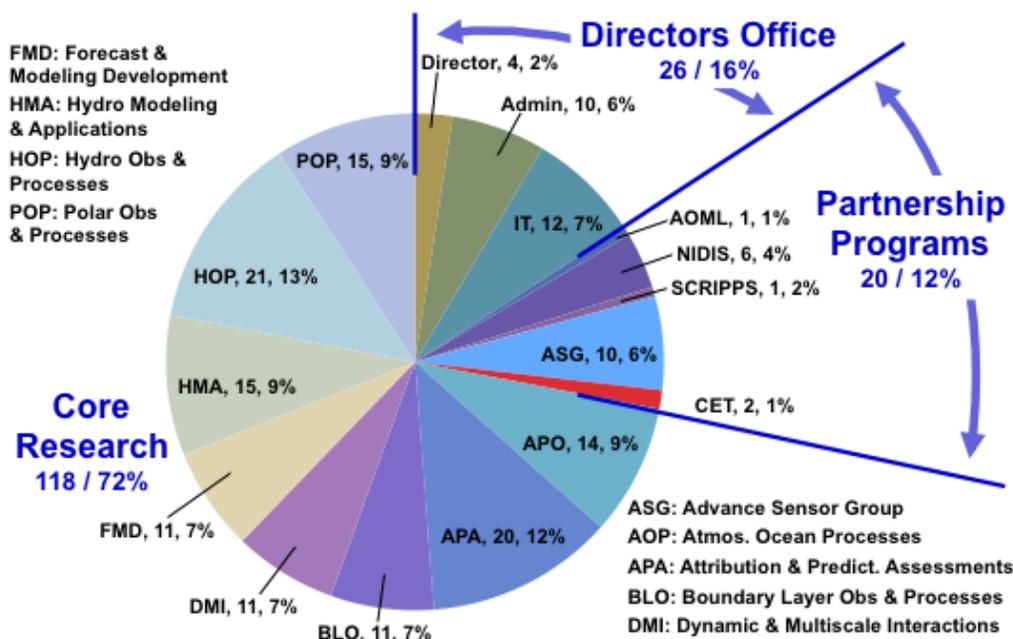
Guest/Visiting Researcher	
Martin	Ralph
Kathy	Pegion

PSD Staffing by Fiscal Year

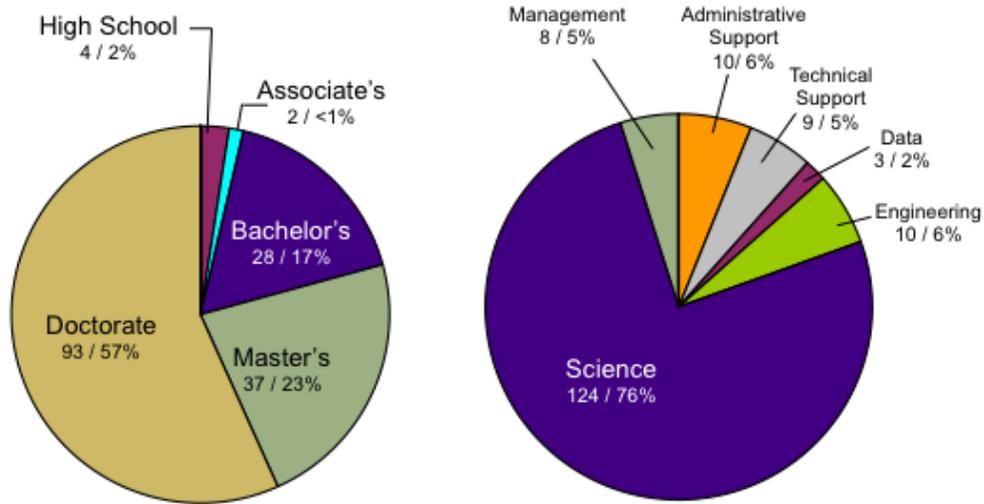


*Guest Workers: Scientists Emeriti (3), Guest Scientists (25), Post-docs (6), Externally Supported Staff (2)

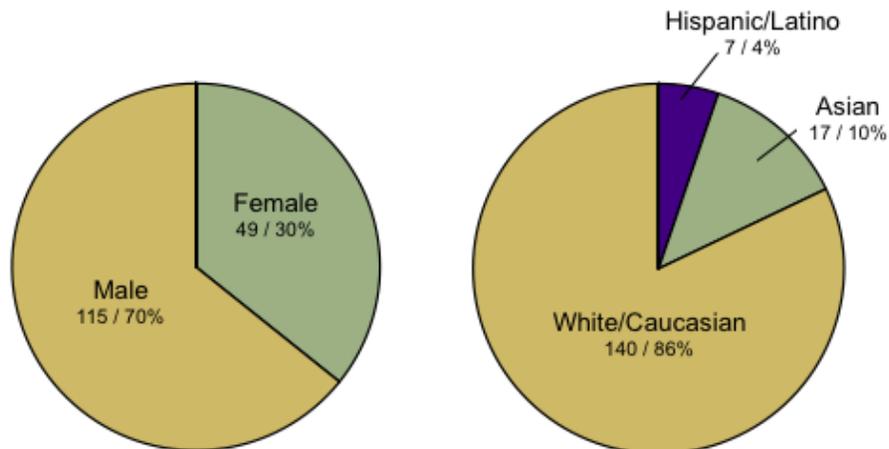
FY15 PSD Staff Distribution (Total=164)



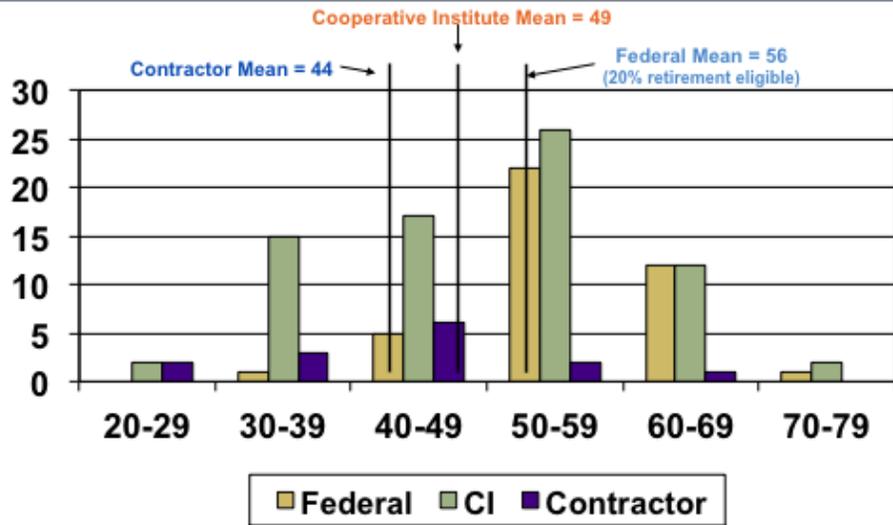
FY15 PSD Staff Degree Distribution and Functions (Total=164)



FY15 PSD Staff Diversity (Total=164)

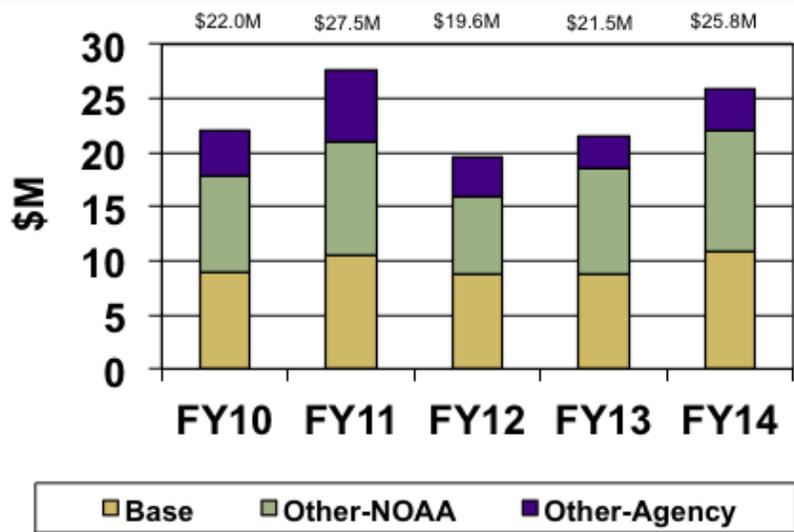


FY15 PSD Staff Age Distribution (Total=164)

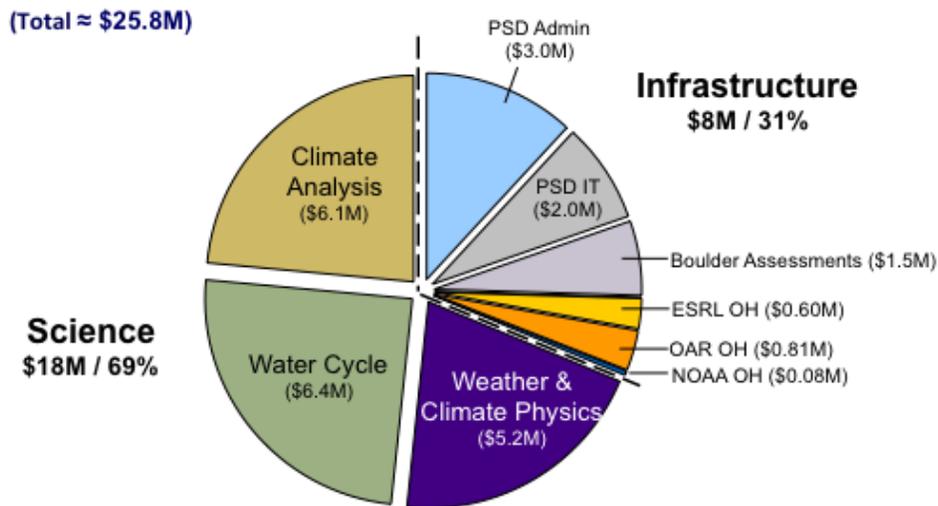


PSD Budget

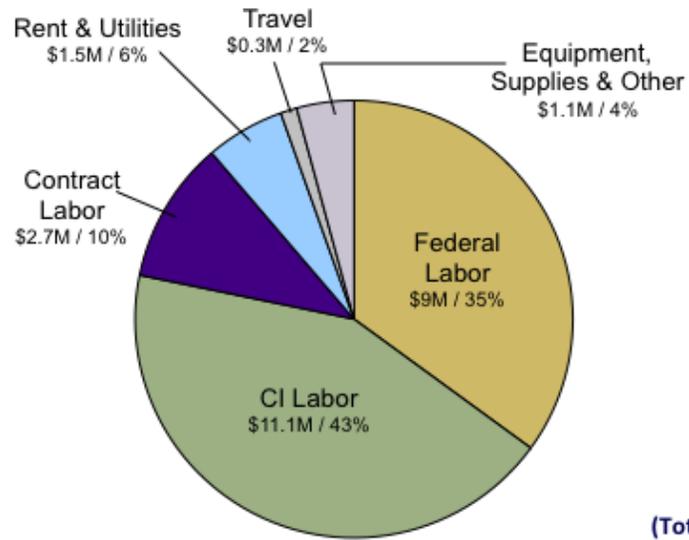
PSD Income by Fiscal Year



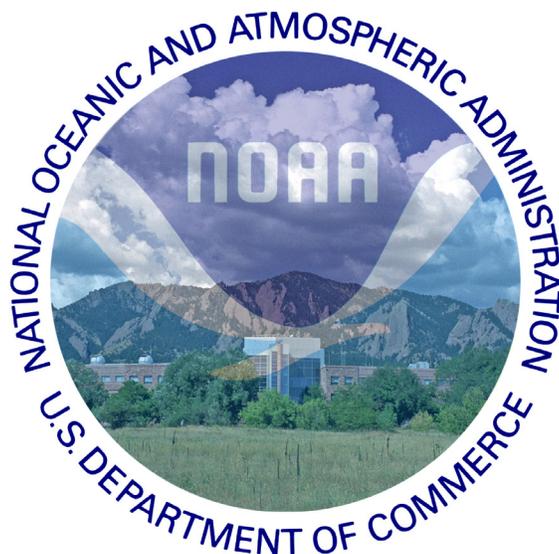
PSD FY14 Expenditures by Function



PSD FY14 Expenditures by Category



C. Publications and Citations



**ESRL Physical Sciences Division
Science Review
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PSD Publications and Citations

Publications

PSD authors publish approximately 120 peer-reviewed papers per year. The table below illustrates the number of papers published for the five calendar years 2010-2014 normalized by the number of PSD publishing scientists (approximately 80). The PSD publication database can be accessed at (<http://www.esrl.noaa.gov/psd/pubs/view/year/2014.html>).

Year	# Publications	Papers/Scientist
2010	106	1.3
2011	115	1.4
2012	118	1.5
2013	137	1.7
2014	117	1.4
Average	119	1.5

Citations

Shown below are the lifetime publication and citation counts, and Hirsch-index¹ or H-index values for current PSD scientists. This list reflect those who have an H-index of 10 or greater (55 scientists). Web of Science[®], which includes only peer-reviewed works, was used to generate the data below.

PSD Author	Total Publications	Total Citations	H-Index
Christopher Fairall	238	8087	44
Henry Diaz	138	6346	42
George Kiladis	113	5795	40
Martin Hoerling	91	4608	37
Michael Alexander	87	4358	36
Prashant Sardeshmukh	70	4010	33
Thomas Hamill	69	3965	29
Sergey Matrosov	109	2140	29
Ola Persson	56	2217	28
Matthew Shupe	75	2394	28
Paul Neiman	79	2135	27
Judith Perlwitz	61	2984	27
Allen White	68	2048	27
Brant Liebmann	54	3186	25

PSD Author	Total Publications	Total Citations	H-Index
Cécile Penland	44	1831	23
Robert Pincus	40	2198	23
Jeffrey Whitaker	49	3325	23
James Wilczak	58	2057	23
William Neff	72	2140	23
Christopher Williams	60	1398	23
Byron Blomquist	50	1320	22
Robert Cifelli	46	1253	22
Matthew Newman	39	2034	22
Edward Walsh	61	1324	21
David Kingsmill	37	1004	20
David Carter	43	1127	19
Randall Dole	36	1248	19
Philip Pegion	31	1954	19
Ryan Spackman	55	1388	19
Robert Webb	36	1801	19
Gary Bates	28	3061	18
Gary Wick	58	1535	18
Gilbert Compo	32	5796	17
Lisa Darby	30	981	17
David Reynolds	51	832	17
Oleg Godin	129	870	16
Janet Intrieri	22	1109	16
Darren Jackson	28	918	15
Paul Johnston	34	546	15
De-Zheng Sun	31	738	15
Alexander Voronovich	65	899	15
Robert Zamora	37	632	15
Valery Zavorotny	52	815	15
Antonietta Capotondi	32	909	14
Vladimir Ostashev	87	633	14
Richard Lataitis	35	488	13
James Scott	27	1188	13
Laura Bianco	23	282	12
Irina Djalalova	16	360	12
Alfred Bedard	61	429	11
Klaus Wolter	18	713	11
Joseph Barsugli	22	671	10

PSD Author	Total Publications	Total Citations	H-Index
Ben Livneh	20	380	10
Lesley Smith	13	675	10
Amy Solomon	26	526	10

¹ Hirsch, J. E., 2005: An index to quantify an individual's scientific research output. *Proceedings of the National Academy of Sciences*, **102** (46), 16569-16572, doi:10.1073/pnas.0507655102

HIGHLY CITED (> 100 CITATIONS)

A number of PSD scientists have publications that have been cited over 100 times. Examples include:

Deser, C., M. A. Alexander, S.-P. Xie, and A. S. Phillips, 2010: Sea surface temperature variability: Patterns and mechanisms. *Annual Review of Marine Sciences*, **2**, 115-143.

Fairall, C.W., E.F. Bradley, D.P. Rogers, J.B. Edson, and G.S. Young, 1996: Bulk parameterization of air-sea fluxes for TOGA COARE. *J. Geophys. Res.*, **101**, 3747-3767.

Fairall, C. W., J. E. Hare, J. B. Edson, and W. McGillis, 2000: Parameterization and micrometeorological measurement of air-sea gas transfer. *Bound.-Layer Meteorol.*, **96**, 63-105.

Intrieri, J. M. C. W. Fairall, M. D. Shupe, P. O. G. Persson, E. L. Andreas, P. S. Guest, and R. E. Moritz, 2002: Annual cycle of cloud forcing at SHEBA. *J. Geophys. Res.*, **107**, 8039.

Fairall, C.W., J. Kepert, and G.J. Holland, 1995: The effect of sea spray on surface energy transports over the ocean. *The Global Atmospheric Ocean System*, **2**, 121-142.

Kiladis, G. N., M. C. Wheeler, P. T. Haertel, K. H. Straub, and P. E. Roundy, 2009: Convectively coupled equatorial waves. *Rev. Geophys.*, **47**, RG2003.

Kiladis, G. N., K. H. Straub, and P. T. Haertel, 2005: Zonal and vertical structure of the Madden-Julian Oscillation. *J. Atmos. Sci.*, **62**, 2790-2809.

Lin, J. -L, G. N. Kiladis, et al., 2006: Tropical intraseasonal variability in 14 IPCC AR4 climate models: Part I: Convective signals. *J. Climate*, **19**, 2665-2690.

Matrosov, S.Y., K.A. Clark, B.E. Martner, and A. Tokay, 2002: X-band polarimetric radar measurements of rainfall. *J. Appl. Meteor.*, **41**, 941-952.

Neiman, P.J., F.M. Ralph, A.B. White, D.E. Kingsmill, and P.O.G. Persson, 2002: The statistical relationship between upslope flow and rainfall in California's coastal mountains: Observations during CALJET. *Mon. Wea. Rev.*, **130**, 1468-1492.

Newman, M., G. P. Compo, M. A. Alexander, 2003: ENSO-forced variability of the Pacific Decadal Oscillation. *J. Climate*, **16**, 3853-3857.

Penland, C. and P. D. Sardeshmukh, 1995: The optimal growth of tropical sea-surface temperature anomalies. *J. Climate*, 8, 1999-2024.

Perlwitz, J., and H.-F. Graf 1995. The statistical connection between tropospheric and stratospheric circulation of the Northern Hemisphere in winter. *J. Climate* 8, 2281-2295.

Perlwitz, J., and N. Harnik, 2003: Observational evidence of a stratospheric influence on the troposphere by planetary wave reflection. *J. Climate* 16, 3011-3026.

Perlwitz, J., S. Pawson, R. L. Fogt, J.E. Nielsen, and W. D. Neff, 2008: Impact of stratospheric ozone hole recovery on Antarctic climate, *Geophys. Res. Lett.*, 35, L08714.

Persson, P. Ola G., C. W. Fairall, E. L. Andreas, P. S. Guest, and D. K. Perovich, 2002: Measurements near the Atmospheric Surface Flux Group tower at SHEBA: Near-surface conditions and surface energy budget. *J. Geophys. Res.* 107(C10).

Ralph, F.M., P.J. Neiman, and G.A. Wick, 2004: Satellite and CALJET aircraft observations of atmospheric rivers over the eastern North-Pacific Ocean during the winter of 1997/98. *Mon. Wea. Rev.*, 132, 1721-1745.

Sardeshmukh P.D., and B.J. Hoskins, 1988: The generation of global rotational flow by steady idealized tropical divergence. *J. Atmos. Sci.*, 45, 1228-1251.

Thomas, C. R., M. Alexander, and D. Lawrence, 2010: The seasonal atmospheric response to projected Arctic sea ice loss in the late 21st Century. *J. Climate*, 23, 333-351.

Whitaker, J. S., T. M. Hamill, X. Wei, Y. Song, and Z. Toth, 2008: Ensemble data assimilation with the NCEP Global Forecast System. *Mon. Wea. Rev.*, 136, 463–482.

Wilczak, J. M., S. P. Oncley, S.A. Stage (2001): Sonic anemometer tilt correction algorithms. *Boundary-Layer Meteorology*, 99, 127-150.

Zavorotny, V. U. and A. G. Voronovich, 2000: *IEEE Trans Geosci. Remote Sens.*, 38, 951-964.

HIGHLY CITED (WEB-OF-SCIENCE TOP 1% IN FIELD FOR GIVEN YEAR)

A number of PSD scientists have publications with a Web of Science Highly cited designation for receiving “enough citations to place the publication in the top 1% of its academic field based on a highly cited threshold for the field and publication year.” Examples include:

Alexander M. A., K. H. Kilbourne, J. A. Nye, 2014: Climate variability during warm and cold phases of the Atlantic Multidecadal Oscillation (AMO) 1871-2008. *Journal of Marine Systems*, 133, 14-26.

Bennartz, R., M. D. Shupe, D. D. Turner, V. P. Walden, K. Steffen, C. J. Cox, M. S. Kulie, N. B. Miller, and C. Pettersen, 2013: July 2012 Greenland melt extent enhanced by low-level liquid clouds. *Nature*, 496, 83-86. Compo, G. P., J. S Whitaker, P. D. Sardeshmukh, et al. (2011): The Twentieth Century Reanalysis Project. *Q.J.R. Meteorol. Soc.*, 137: 1–28.

Deser, C., A. S. Phillips, M. A. Alexander, and B. V. Smoliak, 2014: Projecting North American Climate over the next 50 years: Uncertainty due to internal variability. *J. Climate*, 27, 2271-2296.

Dole, R. M., Hoerling, J. Perlwitz, et al., 2011: Was there a basis for anticipating the 2010 Russian heat wave? *Geophys. Res. Lett.*, 38, L06702.

Hoerling, M. J. Eischeid, A. Kumar, et al., 2014: Causes and predictability of the 2012 Great Plains Drought. *Bull. Am. Meteorol. Soc.*, 95, 269-282.

Hoerling, M., J. Hurrell, J. Eischeid; et al., 2006: Detection and attribution of twentieth-century northern and southern African rainfall change. *J. Climate*, 19, 3989-4008.

Hoerling, M., J. Eischeid, J. Perlwitz, et al., 2012: On the increased frequency of Mediterranean drought. *J. Climate*, 25, 2146-2161.

Morrison, H., G. de Boer, G. Feingold, J. Harrington, M. D. Shupe, and K. Sulia, 2012: Resilience of persistent Arctic mixed-phase clouds. *Nature Geoscience*, 5, 11-17,

Peterson, T. C., M. P. Hoerling, P. A. Stott and S. C. Herring et al., 2013: Explaining Extreme Events of 2012 from a climate perspective. *Bull. Amer. Meteorol. Soc.*, 94, S1-S74.

Stock, C. A., M. A. Alexander, et al., 2010: On the use of IPCC-class models to assess the impact of climate on living marine resources. *Progress in Oceanography*, 88, 1-27.

Vano, J., ... M. P. Hoerling, ..., R. S. Webb, et al., 2014: Understanding uncertainties in future Colorado River streamflow. *Bull. Amer. Meteorol. Soc.*, 1, 59-78.

Wolter, K., and M.S. Timlin (2011): El Niño/Southern Oscillation behaviour since 1871 as diagnosed in an extended multivariate ENSO index (MEI.ext). *Int. J. Climatology*, 31, 1074-1087.

Assessments

PSD generates a number of assessments that utilize observational data and experiments with climate and hydrological models of different complexity to determine the physical factors that cause observed regional and seasonal climate trends and high-impact weather events. These assessments provide the best available science regarding factors causing high-impact weather and climate related extremes to allow policy makers to make informed decisions on how society should invest in critical infrastructure in risk-prone areas while ensuring resiliency. Some of these assessments are captured in peer-reviewed publications, but others are often summarized in reports or fact sheets. Below is a list of recent PSD assessment topics. More information can be found at <http://www.esrl.noaa.gov/psd/csi/>.

- 2013 Colorado Precipitation (Extreme Event)
- 2010 Russian Heat Wave (Extreme Event)
- 2009-10 Mid-Atlantic Snowstorms (Extreme Event)
- 2011 US Tornado Season (Extreme Event)
- 2012 Spring Warmth (Extreme Event)

- 2012 June Heat (Extreme Event)
- 2012 Hurricane Sandy (Extreme Event)
- 2011 Missouri Basin Flooding (Extreme Event)
- 2012 Central Great Plains Drought (Extreme Event)
- 2011-15 California Drought (Extreme Event)
- 2010 Pakistan Floods (Extreme Event)
- 2011 Texas Drought and Heatwave (Extreme Event)
- 2011 Extreme NAO (Extreme Event)
- 2013-4 Cold Winter (Extreme Event)
- Horn of Africa Rainfall Variability and Trends (Trend)
- Devil's Lake Hydroclimate Assessment (Trend)
- Mediterranean Drought (Trend)
- Great Plains Drought Trends (Trend)
- Sahel Precipitation Trends (Trend)
- Southeastern Australia Rainfall Trends (Trend)
- SW US and NW Mexico Precipitation Trends (Trend)
- Arctic Tropospheric Warming (Trend)
- Southern Africa Precipitation (Trend)
- Indian Monsoon Temperature and Precipitation Trends (Trend)

D. Service



**ESRL Physical Sciences Division
Science Review
May 12-14, 2015**

PSD Service Activities

International

PSD Staff	Agency	Activity	Position/Role	Dates
Joseph Barsugli	CORDEX North America	Executive Committee	Member	2013-2015
Gilbert Compo	Global Climate Observing System	Working Group on Surface Pressure	Co-convener	2003-present
Gilbert Compo	Global Climate Observing System, World Climate Research Program	Working Group on Observational Data Sets for Reanalysis	Member	2007-2011
Gilbert Compo	Reanalyses.org	Advancing reanalysis collaborative website	Co-founder	2010-present
Gilbert Compo	Oldweather.org	Citizen Science data rescue	Science Team member	2013-present
Gilbert Compo	Atmospheric Circulation Reconstructions Over the Earth	7 workshops	Co-convener	2008-present
Lisa Darby	International Polar Year Oslo Science Conference	Session "Land-based atmospheric Arctic observatory networks"	Session Co-convener	2010
Gijs de Boer	International Society for Atmospheric Research using Remotely Piloted Aircraft	Science Steering Committee for 2015 Meeting	Member	2015
Gijs de Boer	Arctic Science Summit Week	Session on "Current and future observing strategies for understanding the evolving Arctic climate and ecological system"	Lead convener	2015
Gijs de Boer	International Polar Year Conference	Session on "Polar observing systems"	Session Convener	2012
Juliana Dias	National Academies of Sciences	National Research Council RAP	Review Panel Member	2015-present
Randall Dole	World Meteorological Organization World Weather Research Program	Year of Polar Prediction Summit Planning Group	Member	2015
Randall Dole	World Meteorological Organization U.S. Delegation	Commission for Atmospheric Sciences CAS-16	Member	2013
Randall Dole	World Meteorological Organization	World Weather Prediction Programme Science Steering Committee	Member	2011-present
Oleg Godin	European Geosciences Union	Session "Acoustic-gravity waves: From ocean and land to space"	Session convener	2013
Thomas Hamill	World Meteorological Organization	WWRP Open Science Conference	Convener	2014
Thomas Hamill	World Meteorological Organization	6th International Symposium on Data Assimilation	Co-convener	2013
Thomas Hamill	World Meteorological Organization	Data Assimilation and Observing Systems Committee	Co-chair (and member)	2012-2015 (2008-2011)
Thomas Hamill	World Meteorological Organization	Working Group for Numerical Experimentation	Member	2008-2014

PSD Staff	Agency	Activity	Position/Role	Dates
Thomas Hamill	World Meteorological Organization	Workshop on Model Uncertainty	Co-organizer	2011
George Kiladis	Intergovernmental Panel on Climate Change	Physical Science Basis Assessment	Expert Reviewer	2012
William Neff	International Society for Acoustic Remote Sensing of the Oceans and Atmosphere	16th International Symposium for the Advancement of Boundary-Layer Remote Sensing	Organizer	2012
William Neff	European Geosciences Union	Boundary Layer Physics and Chemistry in High Latitudes	Convener	2006-present
Judith Perlwitz	Intergovernmental Panel on Climate Change	Assessment Report (WG1) Physical Science Basis	Lead Author	2010-2013
Judith Perlwitz	Intergovernmental Panel on Climate Change	Assessment Report (WG1) Physical Science Basis	Contributing Author	2010-2013
Judith Perlwitz	World Meteorological Organization	Assessment Report on Status of Ozone Depletion	Chapter Editor	2013-2014
Judith Perlwitz	World Meteorological Organization	Assessment Report on Status of Ozone Depletion	Contributing Author	2013-2014
Ola Persson	International Arctic Science Committee	MOSAIC Organizing Committee	Member	2011-present
Robert Pincus	World Climate Research Program	Grand Challenge on Clouds, Circulation, Climate Sensitivity	Lead, Initiative on Leveraging the Past Record	2013-present
Robert Pincus	Working Group on Climate Models Climate Model Intercomparison Project	Radiative Forcing Model Intercomparison Project	Lead Coordinator	2014-present
Amy Solomon	World Meteorological Organization	WWRP Open Science Conference	Convener	2014
Ryan Spackman	World Weather Research Program	Predictability and Dynamical Processes	Representative	2012
Ryan Spackman	Korea National Institute for Environmental Research	Geostationary Environmental Monitoring Spectrometer (GEMS) Science Advisory Group	Member	2012-2015
Sandy Starkweather	International Arctic Science Committee	First IASOA Workshop on Radiation and Black Carbon	Chair	2013
Sandy Starkweather	International Arctic Science Committee International Global Atmospheric Chemistry	Workshop on Future Directions for Arctic Air Pollution Research	Co-chair	2015
Sandy Starkweather	International Arctic Science Committee International Global Atmospheric Chemistry	Arctic Air Pollution Initiative	Steering Committee	2015-present
Sandy Starkweather	WMO Global Cryosphere Watch	CryoNet Implementation Team	Advisory Committee	2013-present
Sandy Starkweather	WMO Global Cryosphere Watch	CryoNet Data Portal Team	Advisory Committee	2013-present
Sandy Starkweather	WMO Global Cryosphere Watch	CryoNet Terminology Team	Co-chair	2015-present
Sandy Starkweather	International Council for Science International Arctic Science Committee	Polar Data Forum II	Organizing Committee	2015-present

PSD Staff	Agency	Activity	Position/Role	Dates
Sandy Starkweather	Sustaining Arctic Observing Networks International Arctic Science Committee	Arctic Observing Summit	Organizing Committee	2015-present
Alexander Voronovich	European Optical Society	Waves in Random and Complex Media	Member of Editorial Board	1996
Valery Zavorotny	GFZ, Potsdam, Germany	Technical Program Committee, Workshop on GNSS reflections	Member	2015
Valery Zavorotny	Technical University of Catalonia, Barcelona, Spain	Technical Program Committee, Workshop on GNSS reflections	Member	2010
Valery Zavorotny	DEIMOS Engenharia S.A., Lisboa, Portugal	E-GEM: European GNSS-R for Earth Monitoring Project, Advisory Board	Member	2014-present

National

PSD Staff	Agency	Activity	Position/Role	Dates
Randall Dole	American Association for the Advancement of Science	Electorate Nominating Committee	Member	2011-14
Randall Dole	NASA Global Modeling and Assimilation Office	Advisory Committee	Member	2009-13
Randall Dole	Climate Change Science Program U.S. Global Change Research Program	International Working on Climate Variability and Change	Co-chair	2001-2011
Randall Dole	U.S. Global Change Research Program	Strategic Plan Team, "Advance Science"	Member	2011
Randall Dole	U.S. Global Change Research Program	Strategic Plan Integration Team	Member	2011
Andrea Ray	U.S. Global Change Research Program	Interagency Climate Projections Team to support the USGCRP Climate Resilience Toolkit (toolkit.climate.gov)	Member	2015 (ongoing)
Lisa Darby	National Hydrologic Warning Council	Session "Drought Monitoring and Early Warning"	Co-convenor and Moderator	2011
Lisa Darby	NIDIS/National Drought Mitigation Center	Building a sustainable network of drought communities workshop; Session "Integrating planning efforts"	Session Chair	2011
Lisa Darby	Universities Council on Water Resources 2011 Conference	Session "Drought Planning"	Session Convenor and Moderator	2011
Michael Alexander	National Climate Assessment	Southwest chapter technical report	Author	2014
Michael Alexander	National Climate Assessment	Ocean chapter of the report	Lead author	2014
Amy Solomon	U.S. Climate Variability and Predictability Program	Decadal Climate Prediction Working Group	Co-chair and Lead Organizer	2010-2011
Janet Intrieri	Study of Environmental Arctic Change	Science Steering Committee	Member	2011-present
Janet Intrieri	U.S. Interagency Arctic Research Policy Committee	Sea Ice Forecasting Implementation Team	Member	2013-present

PSD Staff	Agency	Activity	Position/Role	Dates
Jeffrey Whitaker	NCAR Mesoscale and Microscale Division	Advisory Panel	Member	2015-present
Jeffrey Whitaker	NCAR Developmental Testbed Center	Science Advisory Board	Member	2011-2014
Jeffrey Whitaker	6th EnKF workshop	Organizing Committee	Member	2014
Jessie Creamean	NCAR	Aerosol-cloud Steering Group	Lead	2015-present
Robert Webb	DoD Strategic Environmental Research and Development Program (SERDP)	Scientific Advisory Board	NOAA Representative	2014-present
Robert Webb	Climate Change and Water Working Group	Interagency working group to advance scientific collaborations in support of water management as climate changes	Member	2008-present
Robert Webb	U.S. Global Change Research Program	National Climate Assessment Indicators Workgroup	Member	2012-2014
George Kiladis	NCAR Advanced Study Program	Weather-Climate Intersection, Advances and Challenges Colloquium	Co-Organizer	2012
Matthew Shupe	Study of Environmental Arctic Change	Observing Change Panel	Member	2013-present
Matthew Shupe	Study of Environmental Arctic Change	Arctic Observing Open Science Meeting	Co-chair	2015
Ben Livneh	NASA	NASA User Working Group	Member	2014
Kelly Mahoney	NCAR Developmental Testbed Center	Science Advisory Board	Member	2014-present
Matthew Newman	U.S. Climate Variability and Predictability Program	Decadal Climate Prediction Working Group	Member	2010-2011
Matthew Newman	U.S. Climate Variability and Predictability Program	ENSO Diversity Working Group	Member	2012-present
Antionetta Capotondi	U.S. Climate Variability and Predictability Program	POS Panel	Member	2010-present
Antionetta Capotondi	U.S. Climate Variability and Predictability Program	ENSO Diversity Working Group	Co-chair	2012-present
Antionetta Capotondi	U.S. Climate Variability and Predictability Program	Workshop on "ENSO diversity"	Organizer	2013
Antionetta Capotondi	U.S. Climate Variability and Predictability Program	Variations Newsletter	Guest Editor	2013
Antionetta Capotondi	NCAR	Panel to assess parameterizations for CAM5.5	Panelist	2014-present
Andrea Ray	U.S. Climate Variability and Predictability Program	Predictions, Predictability and Applications Interface Panel	Member	2013-2016

NOAA

PSD Staff	Office	Activity	Position/Role	Dates
Michael Alexander	NMFS	Integrated Ecosystem Assessment (IEA) Scientific Steering Committee	Member	2014-present
Michael Alexander	NMFS	Integrated Ecosystem Assessment (IEA) Annual meeting	Local Host	2013, 2014

PSD Staff	Office	Activity	Position/Role	Dates
Michael Alexander	NMFS	Technical Expert Working Group (TEWG) for River Herring	Co-Chair Climate Change Subgroup	2014-present
Michael Alexander	NMFS	North Atlantic Habitat Blueprint Focus Area Selection Team	Member	2013-2014
Robert Cifelli	NOAA	Steering Group for Precipitation Measurement from Space	Co-Chair	2012-present
Robert Cifelli	NOAA/US BoR/USACE	Climate Change and Water Working Group	Member	2015 (ongoing)
Robert Cifelli	NOAA	Habitat Blueprint - Russian River Habitat Focus Area	OAR Representative	2013-present
Gilbert Compo	NOAA Climate Program Office	Climate Reanalysis Task Force	Co-lead	2013-present
Jessie Creamean	NOAA	CalWater 2 Field Campaign	Lead Chemical Forecaster	2015 (ongoing)
Lisa Darby	NOAA	NOAA Central Region Collaboration Team	Member	2013-present
Lisa Darby	NOAA	NOAA Drought Task Force	Member	2014-present
Barbara DeLuisi	NOAA Boulder	Boulder Outreach Coordinating Committee	Member	2010-present
Barbara DeLuisi	NOAA Boulder	Boulder Editorial Board	Member and Lead (2014-present)	2010-present
Barbara DeLuisi	OAR	Communications Team	Member	2010-present
Barbara DeLuisi	OAR	Editorial Board	Member	2010-present
Randall Dole	NOAA	Council of NOAA Fellows	Member	2013-present
Randall Dole	NOAA	Editor, CNF Ideas and Insights essays	Editor	2015-present
Randall Dole	NOAA	NOAA Committee to develop Scientific Integrity Policy	Team Member	2011
Randall Dole	NOAA	State of Science Fact Sheet on Climate Change and Extremes	Drafting Team Member	2013
Randall Dole	NOAA	NOAA THORPEX Executive Committee	Member	2005-2011
Randall Dole	NOAA	NWS Science and Technology Infusion Program - Climate	Member	2008-2010
Randall Dole	NOAA	Climate Executive Board	Member	2007-2010
Thomas Hamill	NWS	Team Lead, Next-Generation Global Prediction System, Ensemble and Post-processing teams	Team Lead	2014-present
Thomas Hamill	NWS	Team Lead, Sandy Supplemental Project, National Blend of Models Post-processing team.	Team Lead	2013-present
Thomas Hamill	OAR	NOAA THORPEX project	Program Manager	2008-2012
Thomas Hamill	OAR	NOAA/NWS Forecast Uncertainty Steering Team	Member	2010
Thomas Hamill	NWS	Service Assessment Team, Boulder Sep 2013 Floods	Member	2013
Thomas Hamill	NWS	UCACN (UCAR Community Advisory Committee) Modeling Advisory Committee	Member	2015 (ongoing)
Andrea Ray	NWS	Water Resources Monitor & Outlook Steering Team	Member	2015-present
Andrea Ray	NOAA Climate Program Office	CPO Sector Applications Research Program Panel Review	Panel Member	2012
Amy Solomon	NOAA	Modeling, Analysis, Predictions, and Projections Panel Review	Member	2012

PSD Staff	Office	Activity	Position/Role	Dates
Robert Pincus	NWS	Next-Generation Global Prediction System, Physical Parameterizations	Member	2014-present
Janet Intrieri	NOAA	NOAA Alaska Regional Team	OAR Representative	2011-present
Janet Intrieri	NOAA	NOAA Arctic Task Team	OAR Representative	2011-present
Gary Wick	NOAA	NOAA Low Earth Orbiting Requirements Working Group	OAR Representative	2011-present
Gary Wick	NOAA	NOAA Geostationary Orbiting Requirements Working Group	OAR Representative	2011-present
Gary Wick	NOAA	NOAA Ocean Color Coordinating Group	OAR Representative	2011-present
Jeffrey Whitaker	NOAA	NWS Next Generation Global Prediction System (NGGPS) project	Test Manager	2015-present
Jeffrey Whitaker	NOAA	Non-hydrostatic modeling team, High Impact Weather Prediction Project (HIWPP)	Team Lead	2014-present
Robert Webb	NOAA	NOAA West Region Collaboration Team	Member	2005-2014
Robert Webb	NIDS	Implementation Team	Member	2008-present
Robert Webb	NOAA	Drought and Water Resources Climate Goal Execution Project	Co-Lead	2012-2014
Robert Webb	NOAA	Water Quality Team responding to the Ocean Policy Task Force (OPTF) report	Member	2011
Allen White	NOAA	NOAA Testbed and Proving Ground Coordinating Committee	Member	2010-present
Allen White	NOAA	Steering Group for Precipitation Measurement from Space (SGPMS)	Member	2009-2013
Allen White	NOAA	SGPMS Advisory Board	Member	2014-present
Judith Perlwitz	NOAA	Modeling, Analysis, Predictions, and Projections (MAPP) Panel Review	Member	2015 (ongoing)
Judith Perlwitz	NOAA	Climate Model Development Task Force	Member	2014-present
Judith Perlwitz	NOAA	Climate Prediction Task Force	Member	2013-present
Judith Perlwitz	NOAA	Climate Reanalysis Task Force	Member	2013-present
Matthew Newman	NOAA	Climate Prediction Task Force	Co-lead	2012-present
Matthew Newman	NWS	NWS Climate Professional Development Series	Instructor	
James Wilczak	NOAA	NOAA Renewable Energy Team	Member	2013-present
Prashant Sardeshmukh	NOAA	Climate Reanalysis Task Force	Member	2013-present
William Neff	OAR	OAR Financial Principles Committee	Member	2012-2014
William Neff	OAR	OAR HQ Review	Laboratory Representative	2012-2013
William Neff	NOAA	NOAA Representative to the DOD Strategic Environmental Research and Development Program	Member Science Advisory Board	2001-2013
Richard Lataitis	NOAA	NOAA West Regional Collaboration Team	Member	2014-present
Richard Lataitis	NOAA Technology Partnerships Office	NOAA Technology Partnerships Working Group - coordinate OAR technology transfer and SBIR process	OAR Representative	2014
Randall Dole	NOAA	NOAA Science Workshop: Strengthening NOAA Science (2010)	Co-chair	2010

PSD Staff	Office	Activity	Position/Role	Dates
Randall Dole	NOAA	NOAA Climate Science Challenge Workshop: Toward Understanding and Predicting Regional Climate Variations and Change (2011)	Co-chair	2011
Randall Dole	NOAA	Predicting Arctic Weather and Climate and Related Impacts: Status and Requirements for Progress (2014)	Co-chair	2014
Richard Lataitis	OAR	OAR EEO Advisory Committee	Member	2013-present
Spackman	NOAA Boulder	Science and Technology Corporation Contract Management	Program Manager	Spackman

Joint Institute

PSD Staff	Organization	Activity	Position/Role	Dates
Judith Perlwitz	CIRES	Council of Fellows	Member	2011-present
William Neff	CIRES	Council of Fellows	Member	1991-present
William Neff	CIRES	Career Track Committee	Chair	2015
Randall Dole	CIRES	Council of Fellows	Member	1995-present
Randall Dole	CIRES	Division Director, Weather and Climate Dynamics	Member	2005-present
Randall Dole	CIRES	Executive Committee	Member	2005-present
Christopher Fairall	CIRES	Council of Fellows	Member	2000-present
Prashant Sardeshmukh	CIRES	Council of Fellows	Member	2008-present

Other Agency

PSD Staff	Agency	Activity	Position/Role	Dates
Gijs de Boer	U.S. Department of Energy, Atmospheric System, Research Program	Cloud Lifecycle Working Group thematic group on cloud phase partitioning	Group Co-leader	2013-
Gijs de Boer	U.S. Department of Energy Atmospheric System Research and Atmospheric Radiation Measurement Programs	Science and Infrastructure Steering Committee	Member	2015 (ongoing)
Sergey Matrosov	NASA	CloudSat Science Team	Member	2002-present
Michael Alexander	National Science Foundation	Decadal and Regional Climate Prediction using Earth System Models (EaSM) panel	Panel Member	2010
Christopher Williams	NASA	Particle Size Distribution Working Group	Chair	2007-present
Christopher Williams	NASA	Precipitation Measurement Mission (PMM) Science Team	Member	2000-present
Christopher Williams	U.S. Department of Energy, Atmospheric Science, Research Program	DOE ASR Science Team	Member	2011-present

PSD Staff	Agency	Activity	Position/Role	Dates
Joseph Barsugli	U.S. Department of Interior, North Central Climate Science Center	University Consortium Climate Team Co- Lead	Team Lead	2013-present
Amy Solomon	U.S. Department of Energy, Atmospheric System, Research Program	DOE ASR Science Team and Cloud Lifecycle Working Group	Member	2010-present
Amy Solomon	U.S. Department of Energy	Department of Energy Climate Variability and Change Review	Panel Member	2014
Amy Solomon	National Science Foundation	Geoscience Review	Panel Member	2013
Amy Solomon	U.S. Department of Energy	Earth System Modeling Review	Panel Member	2011
Janet Intrieri	NASA ICESat-2	Science Review Board	Member	2013-present
Robert Cifelli	NASA	Precipitation Measurement Mission Science Team	Member	2006-present
Jessie Creamean	U.S. Department of Energy, Atmospheric Science, Research Program	DOE ASR Science Team	Member	2015-present
James Wilczak	U.S. Department of Energy	Atmosphere to Electrons Steering Committee	Co-chair, Instrument Group	2013-present
Robert Webb	U.S. State Department led Team for the Final Declaration negotiations	High-Level Meeting on National Drought Policy (HMNDP)	Member	
Robert Webb	U.S. Department of Interior	Basin Study Program West Wide Risk Assessments Implementation Team	NOAA Representative	2010-2013
George Kiladis	National Science Foundation	External Advisory Panel for the Center for Multi-Scale Modeling of Atmospheric Processes	Chair	2009-2011
Matthew Shupe	U.S. Department of Energy, Atmospheric System, Research Program	Science and Infrastructure Steering Committee	Member	2008-2015
Matthew Shupe	U.S. Department of Energy, Atmospheric System, Research Program	Cloud Life Cycle working group	Chair	2008-2015
Matthew Shupe	U.S. Department of Energy, Atmospheric System, Research Program	Radar Science Committee	Member	2013-present
Matthew Shupe	U.S. Department of Energy, Atmospheric Radiation Measurement Program	User Executive Committee	Member	2015-present
Matthew Shupe	U.S. Department of Energy, Atmospheric Radiation Measurement Program	Science Board	Member	2009-2013
Matthew Shupe	National Science Foundation	Arctic Research Support and Logistics Workshop	Organizing Committee	2013
Gilbert Compo	U.S. Department of Energy,	Lawrence Livermore National Laboratory (LLNL) Science Plan for Climate Change Research Science Focus Area (SFA) Review	Panel Reviewer	2012
Valery Zavorotny	NASA, Jet Propulsion Laboratory	GNSS+R A-team to inform the next Decadal Survey for NASA Earth Science Mission Directorate	Member	2013-present

PSD Staff	Agency	Activity	Position/Role	Dates
Kelly Mahoney	U.S. Army Corps of Engineers (USACE)	USACE, 2013: Mississippi River 2011 Post Flood Assessment: Task 1 – Adequacy of MR&T Project Design Flood Climate Change Impacts on Dew Point Calculation for Maximized 2011 Event to Project Design Storm	Consultant (unpaid)	2013
Antionetta Capotondi	U.S. Department of Energy	Proposal review panel	Panelist	2014
Ola Persson	National Science Foundation	U.S. delegation to US-UK Arctic Research Workshop	Member	2012
Mimi Hughes	National Science Foundation	Steering Committee for connecting hydrologic and meteorological activities	Member	2013-2014

Professional Society

(AMS - American Meteorological Society, AGU - American Geophysical Union)

PSD Staff	Agency	Activity	Position/Role	Dates
Robert Pincus	AGU	Journal of Advances in Modeling Earth Systems	Editor in Chief	2015-
Gijs de Boer	AMS	Committee on Laser Atmospheric Studies	Member	2007-2011
Gijs de Boer	AGU	Session on: "Use of unmanned aircraft in geoscience"	Session Convener	2014
Gijs de Boer	AGU	Session on "Observational needs for polar climate modeling"	Session Convener	2012
Oleg Godin	Acoustical Society of America	Journal of the Acoustical Society of America - Express Letters	Associate Editor	2010-
Thomas Hamill	AMS	Annual Summer Community Meeting	Co-organizer and Session Chair	2014
Thomas Hamill	AMS	Monthly Weather Review	Editor	2008-2010
Thomas Hamill	AMS	Committee for Environmental Responsibility	Member	2008-2012
Thomas Hamill	AMS	Committee for Probability and Statistics	Member	2006-2011
Andrea Ray	AMS	Committee on Climate Services	Member	2011-2015
Andrea Ray	American Fisheries Society	Symposium on Understanding and Responding to Climate Change Impacts on Marine and Coastal Fisheries, to bring together climate and fishery scientists	Co-convener	2012
Lisa Darby	AMS	AMS Information Statement on Drought	Co-author	2013
Lisa Darby	AMS	AMS Mountain Meteorology Committee	Member	2004 - 2010
Michael Alexander	AMS	Bulletin of the American Meteorological Society (BAMS)	Editor	2013-present
Michael Alexander	AMS	Journal of Climate	Editor	2008-2012
Joseph Barsugli	AMS	Journal of Climate	Editor	2014-
Christopher Williams	AMS	36th AMS Conference on Radar Meteorology	Conference Co-chair	Sept 2013

PSD Staff	Agency	Activity	Position/Role	Dates
Christopher Williams	AMS	AMS Radar Committee	Member	2013-present
Amy Solomon	AMS	Meetings Oversight Committee	Member	2010-2011
Mimi Hughes	AMS	Committee on Mountain Meteorology	Member	2015-
Juliana Dias	AMS	Atmosphere and Ocean Fluid Dynamics Committee	Member	2014-present
Juliana Dias	AMS	Monthly Weather review	Associate Editor	2014-present
George Kiladis	Journal on Mathematics of Climate and Weather Forecasting	Editorial Advisory Board	Member	2014-present
George Kiladis	Dynamics of Atmospheres and Oceans	Editorial Board	Member	2003-present
George Kiladis	AMS	Program Committee, 11th International Conference on Southern Hemisphere Meteorology and Oceanography	Member	2014-2015
George Kiladis	AMS	Committee on Atmospheric and Oceanic Fluid Dynamics	Member	2007-2013
James Wilczak	NOAA	Editorial Board, Boundary Layer Meteorology	Member	1992-present
George Kiladis	AMS	Program Committee, 19th Conference on Atmospheric and Oceanic Fluid Dynamics	Member	2012-2013
George Kiladis	AGU	Special Sessions on Equatorial Dynamics	Co-convener	2012-2014
Imtiaz Rangwala	AGU	Session (A11A) on "Accelerated Warming at High Elevations: Evidence, Processes, and Future Projections"	Co-convener	2013
Imtiaz Rangwala	AGU	Session (GC21G) on "Climate Change in Mountains: Elevational Dependency and Diverse Impacts"	Co-convener	2014
Judith Perlwitz	AMS	Journal of Climate	Editor	2013-present
Judith Perlwitz	AGU	Session (GC51) on "Challenges in Attribution and Assessment of Climate Impacts"	Co-convener	2013
Judith Perlwitz	AGU	Session (U44) on "The Attribution of Extreme Weather Events and Their Impacts to External Drivers of Climate Change"	Co-convener	2014
Vladimir Ostashev	Acoustical Society of America	Express Letters of the Journal of the Acoustical Society of America	Associate Editor	2006-present
Vladimir Ostashev	Acoustical Society of America	Journal of the Acoustical Society of America	Associate Editor	2005-present
Matthew Shupe	AMS	Polar Meteorology and Oceanography Committee	Member	2006-2011
Matthew Shupe	Copernicus Publishing	Atmospheric Chemistry and Physics, Atmospheric Measurement Techniques	Guest Editor	2014-present
Gilbert Compo	AGU	session (GC38) on "Challenges in Understanding and Modeling Global-Regional Climate Connections"	Co-convener	2010
Gilbert Compo	AGU	session (GC35) on "Challenges in Understanding and Modeling Global-Regional Climate Connections"	Co-convener	2011
Ben Livneh	AGU	Session on "Hydrologic Regionalization"	Lead Convener	2013

PSD Staff	Agency	Activity	Position/Role	Dates
Ben Livneh	AGU	Session on “Hydrologic Impacts of Land Cover Disturbance”	Lead Convener	2014
David Kingsmill	AMS	Committee on Mountain Meteorology	Member	2014-present
Kelly Mahoney	AMS	AMS Weather Analysis and Forecasting Committee	Member	2009 - present
Kelly Mahoney	Environmental & Water Resources Institute American Society of Civil Engineers	Task Committee on “Use of Physics-based Atmospheric Numerical Models for Estimating Probable Maximum Precipitation”	Member	2014-present
Kelly Mahoney	AMS	AMS Board on Higher Education	Member	2014 - present
Kelly Mahoney	NWA	NWA Committee on Societal Impacts of Weather and Climate	Member	2009 - present
Kelly Mahoney	AMS	Associate Editor of Monthly Weather Review	Associate Editor	2011 - 2013
Kelly Mahoney	AMS	26th Conference on Weather Analysis and Forecasting / 22nd Conference on Numerical Weather Prediction in Atlanta, GA, 2014	Co-chair	2013 - 2014
Kelly Mahoney	AMS	AMS Weather Analysis and Forecasting/Numerical Weather Prediction Symposium at 2013 AMS Annual Meeting in Austin, TX	Co-chair	2012-2013
Sandy Starkweather	AGU	Session on “Arctic Air Pollution”	Co-convener	2013
Matthew Newman	AGU	AGU Fall Meeting Session on “The El Nino/Southern Oscillation Continuum”	Co-convener	2012
Antionetta Capotondi	AGU	Session on El Nino/Southern Oscillation continuum	Co-Convener	2012
Ola Persson	AGU	Session on Radiative Processes Over Sea Ice	Co-organizer	2012
Prashant Sardeshmukh	AGU	AGU Sessions on Regional Climate Variations	Co-Convener	2010, 2011
Ola Persson	Copernicus Publishing	Guest editor for Atmospheric Chemistry and Physics, The Cryosphere, Ocean Science	Editor	2011-present
Ryan Spackman	AGU	CalWater 2 Side Meeting	Organizer	2012-2013

Regional and Local

PSD Staff	Agency	Activity	Position/Role	Dates
Robert Webb	California Central Valley Flood Protection Plan	Climate Change Scope Definition Workgroup and Threshold Approach Work Group	Member	2010-2012
Robert Webb	Western State Water Council	Western States Federal Agency Support Team (WestFAST)	Member	2013
Allen White	Various	CalWater 2 Scientific Steering Group	Member	2014-present
Ryan Spackman	Various	CalWater 2 Scientific Steering Group	Member	2014-present
Ryan Spackman	Various	CalWater 2015 Operations and Implementation Working Group	Lead	2014-present
Ryan Spackman	Various	Scripps Institution of Oceanography - CalWater 2015/ACAPEX Planning Workshop	Organizer	2014
Imtiaz Rangwala	DOI/USGS North Central Climate Science Center	Climate research and advisory roles for natural resource management in North Central Mountains and Great Plains	Lead	2015

PSD Staff	Agency	Activity	Position/Role	Dates
Imtiaz Rangwala	Center for Conservation Science & Strategy, The Nature Conservancy - Colorado	Climate science and risks communication and integration in TNC's conservation projects ; Attend monthly in person meeting at the center	Member	2013-present
Imtiaz Rangwala	Western Water Assessment	Climate research and outreach	Team Member	2013-present
Imtiaz Rangwala	Colorado Water Conservation Board	Climate Change Technical Advisory Group, Colorado Water Conservation Board	Member	2013-2014
Imtiaz Rangwala	Mountain Studies Institute, Durango, Colorado	Conference: Managing for Resiliency in the San Juan Mountains - Adaptation and Planning for Climate Change, Silverton, CO	Co-organizer	2010
Ben Livneh	Water Education Foundation	Lower Colorado River Tour	Resource Speaker	2013

E. Awards, Honors, and Other Recognition



**ESRL Physical Sciences Division
Science Review
May 12-14, 2015**

PSD Awards, Honors and Other Recognition

International

Gijs de Boer – Outstanding Early Career Presentation Award (2014), Global Energy and Water Exchanges Project: *Examples of unmanned aircraft systems use in Arctic atmospheric observation.*

Gijs de Boer – Outstanding Oral Presentation Award (2011), Arctic Science Summit Week: *Characterization of the present-day Arctic atmosphere in CCSM4 (Highlights).*

Mimi Hughes – Outstanding Early Career Presentation Award (2014), Global Energy and Water Exchanges Project: *Objective identification of atmospheric rivers, and implications for extreme precipitation at the basin scale, GEWEX 7th International Scientific Conference, The Hague, Netherlands, July 2014 (M. Hughes, D. Jackson, E. Gutmann, and G. Wick).*

Mimi Hughes – Outstanding Presentation Award (2011) - World Climate Research Program: *Low-frequency variability of and impact of climate change on Southern California's Santa Ana winds, WCRP Climate Research in Service to Society, Denver, CO, October 2011 (M. Hughes, D. Cayan, and A. Hall).*

George Kiladis – Distinguished Chair (2010), Pacific Institute of Mathematics, University of Victoria, British Columbia.

Vladimir Ostashev – Visiting Professor (2013), Ecole Centrale de Lyon, University de Lyon, France.

Klaus Wolter – International Journal of Climatology Prize (2014), Royal Meteorology Society: *For his work on the Multivariate El Niño-Southern Oscillation (ENSO) Index (MEI). His 2011 study published in the International Journal of Climatology with Michael S. Timlin became one of the most influential recent papers in the journal, with the current number of citations exceeding 110.*

Valery Zavorotny, et al. – The Creativity Prize (2014), Prince Sultan Bin Abdulaziz International Prize for Water: *For development of a new, unexpected, and cost-effective technique, GPS Interferometric Reflectometry (GPS-IR), to measure soil moisture, snow depth, and vegetation water content.*

Professional Society

Gilbert Compo, Prashant Sardeshmukh, Jeffrey Whitaker, ...Chesley McColl, et al. – Cover Article (2013), *Geophysical Research Letters*: Compo, G. P., P. D. Sardeshmukh, J. S. Whitaker, P. Brohan, P. D. Jones, and C. McColl, 2013: Independent confirmation of global land warming without the use of station temperatures. *Geophys. Res. Letters*, 40, 12, 3170-3174.

Juliana Dias – *Quarterly Journal* Editor's Award (2013), Royal Meteorology Society: *For exceptional dedication to the theoretical details as part of the review process.*

Oleg Godin – Editor's Citation for Excellence in Refereeing (2014), American Geophysical Union.

Thomas Hamill and others – Cover Article (2011), *Bulletin of the American Meteorological Society*: Hirschberg, P.A., E. Abrams. A. Bleistein, W. Bua, L. Delle Monache, T. W. Dulong, J. E. Gaynor, B.

Glahn, T. M. Hamill, J. A. Hansen, D. C. Hilderbrand, R. N. Hoffman, B. H. Morrow, B. Phillips, J. Sokich, N. Stuart, 2011: A weather and climate enterprise strategic implementation plan for generating and communicating forecast uncertainty information. *Bull. Amer. Meteor. Soc.*, 92, 1651-1666.

Sergey Matrosov – Editor’s Award, *Journal of Atmospheric and Oceanic Technology* (2012), American Meteorological Society: *For several thorough and detailed reviews that greatly improved a number of manuscripts.*

Robert Pincus – Editor’s Citation for Excellence in Refereeing (2013), American Geophysical Union: *For consistently providing constructive and thoughtful reviews for the Journal of Geophysical Research - Atmospheres.*

Matthew Shupe, et al. – Cover Article (2013), *Bulletin of the American Meteorological Society*: Shupe, M. D., D. D. Turner, V. P. Walden, R. Bennartz, M. Cadetdu, B. Castellani, C. Cox, D. Hudak, M. Kulie, N. Miller, R. R. Neely III, W. Neff, and P. Rowe, 2013: High and Dry: New observations of tropospheric and cloud properties above the Greenland Ice Sheet. *Bull. Amer. Meteor. Soc.*, 94, 169-186.

Matthew Shupe and others – Cover Article (2013), *Nature*: Bennartz, R., M. D. Shupe, D. D. Turner, V. P. Walden, K. Steffen, C. J. Cox, M. S. Kulie, N. B. Miller, and C. Pettersen, 2013: July 2012 Greenland melt extent enhanced by low-level liquid clouds. *Nature*, 496, 83-86.

Catherine Smith – Special Award (2013), American Meteorological Society: *For producing and sustaining an extremely user-friendly, web-based interface, making weather and climate data widely accessible to users at all levels.*

Christopher Williams – Editor’s Award, *Journal of Atmospheric and Oceanic Technology* (2012), American Meteorological Society: *For numerous, detailed, and thorough reviews of manuscripts on atmospheric and oceanic technology.*

Valery Zavorotny – Recognition of Best Reviewers for the IEEE Transactions on Geoscience & Remote Sensing (2014-2016), IEEE Geoscience and Remote Sensing Society.

Valery Zavorotny – Distinguished Lecturer (2010), IEEE Geoscience and Remote Sensing Society.

University and Joint Institute

Leslie Hartten – Director’s Diversity Award (2011), Cooperative Institute for Research in Environmental Sciences: *For her extensive volunteer effort with the Significant Opportunities in Atmospheric Research and Science (SOARS) program over the last ten years.*

Paul Johnston, David Costa and David Carter – Outstanding Performance Award for Scientific and Engineering Achievement (2011), Cooperative Institute for Research in Environmental Sciences: *For designing, prototyping, building, and deploying a new network of snow-level radars in California for a joint project with the California Department of Water Resources and Scripps Institution of Oceanography.*

Other-Agency

Joseph Barsugli, et al. – Partners in Conservation Award (2012), U.S. Department of the Interior: *Given jointly to the NOAA/ESRL/Physical Sciences Division and CU/Western Water Assessment for work with the Bureau of Reclamation on the Colorado River Basin Supply and Demand Study.*

Robert Cifelli, et al. – Education and Outreach Award (2010), NCAR Earth Observing Laboratory: *For the organization of the 2009 Advanced Study Program Colloquium, “Exploring the Atmosphere: Observational Instruments and Techniques.”*

Tom Hamill and Jeff Whitaker – Leadership Computing Challenge Award (2010), U.S. Department of Energy Advanced Scientific Computing Research: *14,500,000 processor hours to use Department of Energy (DOE) high-performance computational resources for creating a next-generation multi-decadal “reforecast” data set.*

David Reynolds – Special Recognition Award (2012), California Extreme Precipitation Symposium: *In appreciation and recognition of your contributions over 40 years to improving weather forecasting and operational hydrology.*

Allen White, et al. – Climate Science Services Award (2013), California Department of Water Resources: *These scientists led NOAA implementation of a cooperative partnership between the NOAA Hydrometeorology Testbed program and DWR’s Enhanced Flood Response and Emergency Preparedness program to develop and install a 21st century observing system for extreme precipitation in California.*

Gary Wick, et al. – Group Achievement Award (2011), NASA: *For outstanding achievements during the NASA Genesis and Rapid Intensification Processes (GRIP) airborne Earth science mission.*

Christopher Williams, et al., – Robert H. Goddard Award (2104), NASA: *Awarded to the NASA PMM Ground Validation (GV) Team in the category of Exceptional Achievement in Science.*

Department of Commerce

Randall Dole, et. al., – Bronze Medal Award (2012): *For developing a NOAA Administrative Order on Scientific Integrity Policy and accompanying Handbook on Scientific Misconduct*

Thomas Hamill and Jeffrey Whitaker – Bronze Medal Award (2013): *For excellence in research and development of ensemble-based and hybrid data assimilation techniques that improve operational weather forecasts.*

Martin Hoerling, Chad McNutt and Roger Pulwarty – Silver Medal Award (2014): *For outstanding scientific assessment of the origins of the 2012 Central Great Plains Drought.*

Roger Pulwarty et al. – Gold Medal Award (2010): *For producing a major scientific report detailing the impacts of global climate change in the United States.*

Allen White, Paul Nieman, et al. – Bronze Medal Award (2011): *For comprehensive flood mitigation efforts in response to a severely weakened Howard Hansen Dam project with the potential of catastrophic flooding.*

NOAA

Martin Hoerling, Robert Webb, et al., – **Administrator’s Award** (2011): *For support to the Interagency Working Group addressing flooding and development of a NOAA Decision Support System for Devils Lake.*

Andrea Ray, et al. - **General Counsel Award** (2013): *For exceptional performance and significant contributions to the Office of the General Counsel. The Susitna River Hydropower Project Team was recognized for its outstanding work in identifying the need for important climate studies in the Alaska Susitna River Hydropower Project licensing process, and for prevailing on NOAA’s request to the Federal Energy Regulatory Commission that these studies be conducted.*

Office of Oceanic and Atmospheric Research

Michael Alexander and **James Scott** – Outstanding Scientific Paper Award (2011): Forecasting the dynamics of a coastal fishery species using a coupled climate population model. *Ecological Applications*, 20, 452-464 (J. Hare, M. Alexander, M. Fogarty, E. Williams, J. Scott, 2010).

Amy Solomon, Ola Persson, Matthew Shupe and **Jian-Wen Bao** – Outstanding Scientific Paper Award (2010): Investigation of microphysical parameterizations of snow and ice in Arctic clouds during M-PACE through model-observation comparisons. *Monthly Weather Review*, 137, 3110-3128 (A. Solomon, H. Morrison, P. O. G. Persson, M. D. Shupe, and J.-W. Bao, 2009).

Other

Gilbert Compo – High Performance Computing Innovation Excellence Award (2011), International Data Corporation: *International study has enabled much more detailed and longer (100 years) record of past weather, to improve climate studies.*

Gilbert Compo, Jeffrey Whitaker, Prashant Sardeshmukh, et al., – Great Long-term Datasets (2011), *Wired Magazine*: Completed just this year, the 20th Century Reanalysis Project combines historical records from a hodgepodge of sources - the records of sea captains and explorers, doctors and old news accounts - into detailed weather maps, giving the late-19th and 20th centuries a modern level of meteorological coverage.

Leslie Harrten – Ten Years of Service Award (2010), UCAR SOARS (Significant Opportunities in Atmospheric Research and Science) Program.

Martin Hoerling, et al. – The Leading Global Thinkers of 2013, *Foreign Policy Magazine*: The *Bulletin of the American Meteorological Society* published a special report in 2013, which sought to explain the natural and human-caused climate factors that shaped some of 2012’s extreme weather events. *Foreign Policy*’s editors chose the co-editors of this report for coordinating this groundbreaking collection of studies that “pointed problem-solvers in the right direction” of how to answer tough questions about the role of natural variability and global warming in extreme weather and climate events.

James Wilczak, et al. – Annual Achievement Award (2015), Utility Variable-Integration Group (UVIG): *For contributions to improve wind energy forecasts through the Wind Forecast Improvement Project.*

Klaus Wolter – Governor’s Award for High Impact Research (2014), CO-LABS: *For his work in Sustainability for Helping Colorado Plan for Drought. Dr. Wolter has researched connections between the El Niño-Southern Oscillation (ENSO) and drought, and applied his expertise to support water resource management and drought planning in the state of Colorado and throughout the Southwest.*

Robert Zamora, et al. – Governor’s Award for High Impact Research (2014), CO-LABS: *A team of several dozen scientific colleagues in CIRES and NOAA were selected for investigating the atmospheric impacts of rapidly expanding oil and gas development across the West. The researchers relied on careful independent measurements and rigorous analysis to provide the public and policymakers with the hard data needed to improve understanding about air quality challenges in Colorado, Utah, Wyoming and beyond.*

Fellowships

AMERICAN METEOROLOGICAL SOCIETY

- Henry Diaz
- Randall Dole
- Christopher Fairall
- Martin Hoerling
- David Reynolds

ACOUSTICAL SOCIETY OF AMERICA

- Oleg Godin
- Vladimir Ostashev
- Lev Ostrovsky
- Alexander Voronovich

INSTITUTE FOR ELECTRICAL AND ELECTRONICS ENGINEERS

- Valery Zavorotny

COOPERATIVE INSTITUTE FOR RESEARCH IN ENVIRONMENTAL SCIENCES

- Randall Dole
- Christopher Fairall
- William Neff
- Judith Perlwitz
- Prashant Sardeshmukh

Postdoctoral Research Fellowships

- **John Albers** (2014-2015), National Academy of Sciences, National Research Council
- **Linyin Cheng** (2014-2015), Cooperative Institute for Research in Environmental Sciences
- **Jessie Creamean** (2012-2013), National Academy of Sciences, National Research Council
- **Kelly Mahoney** (2009-2011), University Corporation for Atmospheric Research, Postdocs Applying Climate Expertise
- **Katherine McCaffrey** (2014-2015), National Academy of Sciences, National Research Council
- **Michael Scheuerer** (2013-2014), National Academy of Sciences, National Research Council

Testimonials

Gilbert Compo, et al. – Various national and international expressions of support for [A Practical Guide to Wavelet Analysis](#). Example:

- *I have been using the online Torrence & Compo interactive wavelet plot site for many years to make students familiar with wavelet analysis, as it is simple and user friendly for the students. Utrecht University in the Netherlands (2014).*

Gilbert Compo, et al. – Various national and international expressions of support for the [20th Century Reanalysis Dataset](#). Examples:

- *I'd like to thank you for providing this wonderful long-term data set. I have used it to study Western US's climate variability and found it very useful. (Department of Plants, Soil and Climate, Utah Climate Center, Utah State University, 2011).*
- *Thank you for the earlier reanalysis you have already completed. They have been of great value to science! (Hydrologic & Environmental Systems Modeling, South Florida Water Management District, 2013).*
- *I wanted to thank you so much for your efforts in putting together the 20th Century Reanalysis. This product has been an invaluable resource in our efforts to look at the skill of our seasonal hurricane predictors over a longer period of time. (Department of Atmospheric Science, Colorado State University, 2014).*

Catherine Smith – Various expressions of support for the Physical Sciences Division [Climate and Weather Data Portal and User Tools](#). Examples:

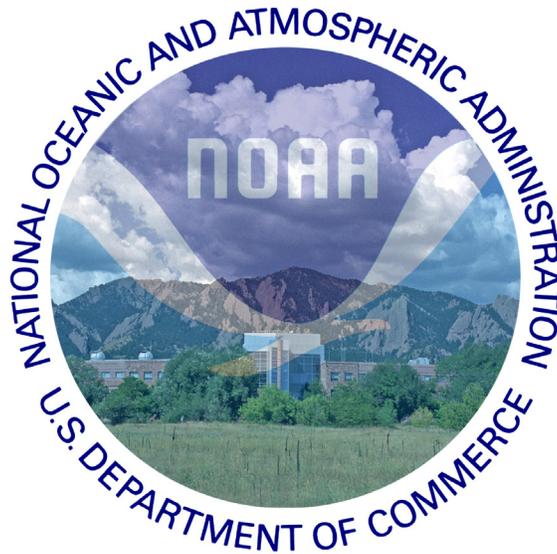
- *I just wanted to provide a quick note on the usefulness of the Daily Mean Composites page that you provide through your web site. What an awesome tool! We (NWS Pocatello) have been using it to generate graphics that are used during outreach activities to the general public and also for retrospective end-of-season reports that are prepared for our partners each season. This is an extremely valuable tool and I want to say, "Job well done!" (Mike Huston, NWS Pocatello, 2011).*

- *I use this page to make monthly, yearly and water year composites for presentations to a number of water resource groups. I also use this for monthly internal reports. (Aldis Strautins, Service Hydrologist NWS, Grand Junction, CO, 2015).*
- *At the undergraduate level I use your pages all the time in the following undergraduate and graduate classes:*
 - *ATM 305: Global Physical Climatology*
 - *ATM 409/509: Atmospheric Precipitation Processes*
 - *ATM 401/501: Synoptic Laboratory II*
 - *ATM 611: Advanced Synoptic-Dynamic Meteorology*
 - *ATM 622: General Circulation of the Atmosphere*
 - *ATM 641: Mesoscale Processes*
- *I use your pages in support of classroom instruction and for student projects (every class I teach has a required student project in which the students have to do a project using real data). Bottom line: Great resource! (Lance Bosart, professor U of Albany, 2012).*
- *No other website widely available is as good as the one you maintain there at NOAA. To lose it would be a big blow to energy meteorologists around the world. (Jess Torpey Senior Meteorologist, E.ON Global Commodities Düsseldorf, Germany, 2014).*
- *This online tool is fantastic! I am a Ph.D. student at the University of Alaska Fairbanks, and this resource is an amazing way to show synoptic overviews for the case study days in my research without laborious data manipulations. (Derek Starkenburg, University of Alaska Fairbanks student, 2014).*
- *I have used ESRL PSD online plotting and analysis tool extensively. This tool is of great help and highly time saving one. The way you have created and designed it is simply superb. It gives access to huge and diverse amount of data without actually downloading it. (Chinmay Khadke, Research Fellow India Meteorological Department Pune, India, 2013).*
- *We used the Monthly/Seasonal Climate Composites page in my Biogeochemical Cycles class today (taught by Dr. Oliver Wingenter), to model the Pacific Decadal Oscillation. Being able to visualize T, P and wind speed variations associated with phase changes in PDO was a great help. (Annie Riggins, Kottlowski Graduate Fellow, New Mexico Institute of Mining and Technology, 2014).*
- *I'd like to thank you for providing this wonderful long-term data set. I have used it to study Western US's climate variability and found it very useful. (Department of Plants, Soil and Climate, Utah Climate Center, Utah State University, 2011).*

Jeffrey Whitaker – Climate Corporation (2015): Recognized for his development and maintenance of a software repository of community python software for GRIB, netCDF data access, for plotting data on maps, and for spherical harmonic transforms:

- *By using Jeff's packages, we and the collective scientific community have saved a tremendous amount of time over the past several years...Jeff's packages are robust, well written, and have met essential needs for weather and climate scientists...we have always found Jeff to be eager to help when we have questions or suggestions.*

F. Stakeholders



**ESRL Physical Sciences Division
Science Review
May 12-14, 2015**

PSD Stakeholders

PSD has a wide variety of stakeholders both from within and outside of NOAA. A representative sample is shown below. PSD stakeholders are users of PSD information, services and products, and often provide feedback on how those products can be improved. In contrast with PSD collaborators, stakeholders do not necessarily work closely with nor sponsor PSD staff to develop products, but rather inform their final form.

PSD Contact	Organization/Contact	What does PSD do that they care about?	Dates
Joseph Barsugli	U.S. Bureau of Reclamation	Develops spatially comprehensive, daily hydrometeorological data set for Mexico, the conterminous U.S., and southern Canada: 1950-2013	2014
Joseph Barsugli	U.S. Bureau of Reclamation	Provides expert guidance on use of climate information; analysis of climatic factors for precipitation extremes;	2008-present
Joseph Barsugli	The Nature Conservancy	Provides expert guidance on use of climate information Development of climate and hydrologic scenarios for landscape conservation activities	2009-2013
Joseph Barsugli	Denver Water, Various front range water entities	Provides expert guidance on use of climate information Interpretation of climate change scenarios	2008-present
Joseph Barsugli	U.S. Department of the Interior, and North Central Climate Science Center	Provides expert guidance on use of climate information Development of climate and hydrologic scenarios for landscape conservation activities Development of datasets, data analysis, and synthesis and assessment of science related to climate change, evapotranspiration, and drought	2012-present
Robert Cifelli Allen White	NOAA National Weather Service	Transitions research into operational weather prediction systems to improve forecasts	2000 - present
Robert Cifelli	NOAA National Weather Service	Transitions research into operational hydrologic prediction systems to improve forecasts	2013-present
Robert Cifelli	NOAA National Marine Fisheries Service	Conducts research to improve habitat for endangered fisheries (Habitat Blueprint - Russian River)	2013-present
Robert Cifelli Allen White	Sonoma County Water Agency	Precipitation observations and forecasts; frost forecasts	2012-present
Lisa Darby	Numerous federal, state, NGO, university, and municipal entities in the Southeast U.S. (e.g., NWS/SERFC; USACE/Mobile; states of AL and GA; FSU; UF - plus many more)	Coordination of weather, climate, and drought early warning information (through NIDIS)	2009-2014
Christopher Fairall	NOAA Climate Program Office Climate Observations Division	Deploys high-quality instruments on ship for quality assurance of the climate observations from buoys and research vessels.	2003 -present

PSD Contact	Organization/Contact	What does PSD do that they care about?	Dates
Thomas Hamill	NCEP Weather Prediction Center NWS Regions NWS Weather Forecast Offices	Provides experimental reforecast based guidance for probabilistic quantitative precipitation forecasts via web applications and in grib files	2010-present (with successive improvements)
Thomas Hamill	NWS Meteorological Development Lab	Provide methods for post-processing and blending of ensemble forecasts for use in the NWS National Blend of Models.	2014-present
Thomas Hamill	NWS Office of Hydrologic Development	Provides NCEP global ensemble reforecast data for the development of calibrated streamflow guidance.	2004-present
Thomas Hamill	NCEP Climate Prediction Center	Provides reforecasts and statistically post-processed forecast guidance for use in the 6-10 day and week +2 forecasts.	2004-present
Thomas Hamill	NCEP Storm Prediction Center	Provides experimental long-lead tornado probability forecasts.	2014-present
Thomas Hamill	Various, including universities, government labs, foreign researchers	Provides NCEP global ensemble reforecast data for a variety of research, development, and operational applications.	2004-present
Michael Hobbins	USGS North Central Climate Science Center (Imtiaz Rangwala)	Provision of climate-scale projections of evaporative demand for North Central CSC region (northern Great Plains) Assessment of optimal evaporative demand models and drivers	2015 (ongoing)
Michael Hobbins	USGS/EROS - Earth Resources Observation Systems, (Gabriel Senay)	Provision of daily, CONUS-wide ET0 (potential evapotranspiration) for actual ET input to USGS National Water Census	2015 (ongoing)
Michael Hobbins	FEWS NET - Famine Early Warning System Network, (Jim Verdin)	Provision of daily, E. Africa-wide ET) reanalysis for SPEI (Standardized Precipitation-Evapotranspiration Index) for FEWS NET-funded researchers	2015 (ongoing)
Michael Hobbins	NIDIS - National Integrated Drought Information Service, (Jim Verdin)	Provision of daily, CONUS-wide ET0 for EDDI (Evaporative Demand Drought Index) and drought monitoring and early warning for NIDIS stakeholders	2015 (ongoing)
Michael Hobbins	CO State Univ./CIRA CO State Climatologist Office, (Nolan Doesken, Wendy Ryan)	Weekly provision of EDDI at multiple temporal scales across CO	2015 (ongoing)
Michael Hobbins	U.S. Forest Service, Rocky Mountain Research Station, Ft. Collins, CO, (Charlotte Ham)	Monthly provision of 1-month EDDI for use in seasonal forecasting of large fires and their suppression costs	2015 (ongoing)
Martin Hoerling	NWS	Regular input to ENSO Diagnostic Discussion	2010-present
Martin Hoerling	U.S. Army Corps of Engineers	Assessment Report and ongoing studies for Missouri Basin Flooding	2012-current
Martin Hoerling	FEWS NET - Famine Early Warning System Network	Long term climate change impact on African monsoons	2011-current

PSD Contact	Organization/Contact	What does PSD do that they care about?	Dates
Martin Hoerling	U.S. Bureau of Reclamation	Mechanisms for regional climate change studies	2011-2013
Martin Hoerling	U.S. Army Corps of Engineers	Study of Devils Lake Flooding	2011-2012
Andrea Ray	NOAA National Marine Fisheries Service, (Sue Walker)	Provides knowledge on climate risks for habitat planning	2011-present
Andrea Ray	Stephen Torbit Assistant Regional Director Science Applications USFWS Region 6	Provides expert guidance on use of climate projections in FWS management and trust resource issues, including science planning, endangered species issues, risks of climate change to habitats, climate issues that FWS should be aware of	20121-present
Allen White	California Department of Water Resources	Deploys specialized observing networks and conducts observationally based physical process studies aimed at improving hydrometeorological forecasts of high impact events	2008-present
James Wilczak	U.S. Department of Energy Various wind farm operators, and other energy partners in the private sector	Deploys instruments to conduct research leading to improved wind energy forecasts	WFIP 1: 2011-2013 WFIP 2: 2015-2017
Heather Yocum	U.S. Fish and Wildlife Service Plains and Prairie Potholes Landscape Conservation Cooperative	Provides knowledge on climate risks for habitat and ecosystem planning and management; solicits stakeholder perspectives on climate information needs	2014-present

G. Collaborators and Sponsors



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PSD Collaborators

PSD maintains collaborations both within and outside of NOAA. Collaborations can be between individuals, groups or organizations. They can be partnerships or sponsored relationships. A representative sample submitted by PSD staff appears below. Organizations may appear multiple time to illustrate a range of activities within each.

Partners

INTERNATIONAL

Organization	Activity	Dates
Aarhus University Denmark	Development of Danish contribution to the International Arctic Systems for Observing the Atmosphere framework	2013-present
Alfred Wegener Institute, Germany	International working group to advance understanding of Arctic radiation	2013-present
Alfred Wegener Institute, Germany	International working group to advance understanding of Arctic radiation	2014-present
Australian Bureau of Meteorology	Investigation of influence of diurnal warming on SST analyses	2012-present
Dalhousie University, Canada	International working group to advance understanding of Arctic energy, moisture and gas fluxes	2013-present
ECMWF	20th Century Reanalysis Project, ERA20C, International Surface Pressure Databank	2012-present
Environment Canada	International working group to advance understanding of Arctic aerosols Global Cryosphere Watch/Cryonet Program	2012-present
ETH, Switzerland	Greenland surface energy budget studies	2012-present
Finnish Meteorological Institute	Coauthors on book chapter	2013-present
Finnish Meteorological Institute	International working group to advance understanding of Arctic aerosols	2013-present
French-German Institute at Saint-Louis, France	Refraction corrections in source localization	2009-present
Hanyang University, South Korea	ENSO diversity working group activities	2012-present
Hebrew University of Jerusalem	Satellite comparison for CalWater 2011	2012-2013
IITM/Pune India	Joint Research on Indian Monsoon	2000-2014
IPSL, Paris, France	Collaborate on ENSO metrics ENSO diversity working group activities	2012-present

Organization	Activity	Dates
Japan Agency for Marine-Earth Science and Tech.	International working group to advance understanding of Arctic radiation	2015-present
Japan Agency for Marine-Earth Science and Technology, Yokosuka, Japan	20th Century Reanalysis Project, International Surface Pressure Databank	2010-present
KNMI, The Netherlands	20th Century Reanalysis Project, International Surface Pressure Databank	2005-present
LATMOS Paris, France	Collaborate on international planning for Arctic atmospheric chemistry initiatives	2013-present
Leeds University, UK	Ice microphysics	2013-present
LEGOS, Toulouse, France	Collaborate on ENSO influence on coastal upwelling	
Max Planck Institute for Meteorology	Extended yearly visits, collaboration, student and postdoc mentoring, six publications resulting	2009-present
NIWA, New Zealand	20th Century Reanalysis Project, International Surface Pressure Databank	2010-present
NIWA, New Zealand	20th Century Reanalysis Project, International Surface Pressure Databank	2010-present
Norwegian Meteorological Institute	Development of data harvesting strategies for Arctic data and metadata exchange; SIOS and GCW	2012-present
Plymouth Marine Laboratory, UK	Air-sea transport of trace gases, chemical flux measurement technology, atmospheric sulfur cycle	2008-present
Technical University of Catalonia, Barcelona, Spain	Airborne GNSS-R wind retrievals using delay-Doppler maps Wind direction retrieval from GPS ocean-scattered signals in airborne experiments Airborne GNSS-R wind retrievals using delay-Doppler maps	2011-2014
Technische University Dresden, Germany	Acoustic tomography of the atmosphere	2001-present
UFZ, Hemholtz Institute Leipzig, Germany	Collaborator on Hydrologic Regionalization projects pertaining to regional scale hydrology and parameter transfer	2012-present
UK Met Office	Atmospheric Circulation Reconstructions over the Earth Initiative - 20th Century Reanalysis Project, International Surface Pressure Databank - co-Conveners of GCOS AOPC/OOPC Working Group on Surface Pressure	2001-present
UK Met Office	Oldweather.org, 20th Century Reanalysis Project, International Surface Pressure Databank	2011-present
UK Met Office	International Surface Pressure Databank	2004-present

Organization	Activity	Dates
Univ. Leeds, UK	Collaborative field projects dealing with air-sea transport of gases and aerosols	2010-present
University of New South Wales, Australia	Parameterization of sea spray production in hurricanes	2000-2015
University of Barcelona	Influence of summer North Atlantic Oscillation on European rainfall	2010-present
University of Bern, Switzerland	20th Century Reanalysis Project, International Surface Pressure Databank	2001-present
University of Bern, Switzerland	Rescuing and evaluating pressure observations from the early 19th century	2013-present
University of Bern, Switzerland	Comprehensive Historical Upper Air Network	2008-present
University of British Columbia	Precipitation sample collection during CalWater 2015	2015
University of Buenos Aires	Intraseasonal climate variability in South America	2004-present
University of Giessen, Germany	20th Century Reanalysis Project, International Surface Pressure Databank	2010-present
University of Leeds	Arctic field project data collection; data analyses	2008-present
University of Oslo, Norway	Effects of global warming on the Pacific Walker circulation	2011-present
University of Portsmouth, UK	Climate change in mountains	2013-present
University of Stockholm	Arctic field project data collection; data analyses	2000-present
Yonsei University	Geostationary Remote Infrared Pollutions Sounder (GRIPS) development	2012-present

NATIONAL

White House

Office	Activity	Dates
Office of Science and Technology Policy	Development of implementation strategies for Interagency Arctic Research Policy Committee	2012-present

NOAA

Organization	Activity	Dates
NCEP Climate Prediction Center	Development of reanalyses, reforecasts, and extended-range statistically post-processed guidance.	Ongoing
NCEP Weather Prediction Center	Development and testing of experimental statistically post-processed guidance	Ongoing

Organization	Activity	Dates
NESDIS Center for Satellite Applications and Research	Integration of diurnal warming information in SST analyses	2013-2015
NESDIS National Climatic Data Center	Development of 20th Century Reanalysis Project, International Surface Pressure Databank	2006-present
NESDIS National Climatic Data Center	Development of International Surface Pressure Databank	2008-present
NESDIS National Climatic Data Center	20th Century Reanalysis Project, International Surface Pressure Databank	2006-present
NESDIS National Climatic Data Center	20th Century Reanalysis Project, International Surface Pressure Databank, ICOADS	2001-present
NESDIS	Development of international working group to advance understanding of Arctic radiation and development of Global Cryosphere Watch/Cryonet Program	2012-present
NESDIS	International working group to advance understanding of Arctic radiation	2013-present
NWS Office of Hydrologic Development	Develop new algorithms/methodologies to improve QPE, especially in complex terrain	2013-present
NWS Office of Hydrologic Development	NOAA Hydrolab distributed model development	2010
NWS National Centers for Environmental Prediction	ENSO Diversity working group activities	2012-present
NWS/NCEP Environmental Modeling Center	Various activities, including reanalysis, reforecast, ensemble prediction system, and data assimilation systems.	Ongoing
NWS/NCEP Climate Prediction Center	Joint research on seasonal variability and predictability studies	1994-present
NWS/NCEP Climate Prediction Center	Joint project on Stratosphere Improvements in CFS	2010-2013

Organization	Activity	Dates
NWS/NCEP Environmental Modeling Center	NOAH land surface model validation	2010-
NWS/NCEP Climate Prediction Center	Developing next generation climate reanalysis for NOAA	2010-present
NWS/NCEP Environmental Modeling Center	20th Century Reanalysis Project, International Surface Pressure Databank, developing next generation climate reanalysis for NOAA	2001-present
NWS/NCEP Climate Prediction Center	Developing new parameterizations of stratospheric ozone and water vapor for NCEP global atmospheric models	2012-present
NWS/OST Meteorological Development Lab	Various activities, including ensemble statistical post-processing	Ongoing

NOAA Office of Oceanic and Atmospheric Research

Organization	Activity	Dates
Air Resources Laboratory	Air quality forecasting for ozone and PM2.5	2014-present
Atlantic Oceanographic and Meteorological Laboratory	Measurement and parameterization of air-sea flux of trace gases	1998-2015
Climate Program Office	Detail to the NOAA Arctic Research Program	2013
ESRL Chemical Sciences Division	Meteorological measurement and analysis for various air quality and air chemistry studies	2006-present
ESRL Global Monitoring Division	International working group to advance understanding of Arctic aerosols and radiation Joint work on Greenland surface-atmosphere interactions	2013-present
ESRL Global System Division	Meteorological measurement and analysis for various regional model improvement studies	2011-present
Geophysical Fluid Dynamics Laboratory	Conduct research on various aspects of ENSO, climate extremes and marine tipping points	2012-present
National Severe Storms Laboratory	Joint project on clouds-atmosphere over Greenland	2010-present
Pacific Marine Environmental Laboratory	Measurement of Air-sea fluxes from TAO buoys	2001-2015
Unmanned Aircraft System Program	Detail to the NOAA UAS Program	2014-2015

Other Agency

Organization	Activity	Dates
Bigelow Marine Laboratory	Marine chemistry air-sea transport of dimethyl sulfide	2007-present
DOE	Development of WFIP1 and WFIP2	2011-present
DOE Lawrence Berkeley National Laboratory	Joint studies on Arctic clouds and radiation	2009-2012
DOE Lawrence Berkeley National Laboratory	Collaborate on ENSO influence on global precipitation	2014-present
DOE National renewable Energy Laboratory	Economic value of forecasts	2014-present
DOE Pacific Northwest National Laboratory	G1 microphysical measurements comparison with aerosol observations	2012-2013
DOE Pacific Northwest National Laboratory	Instrumentation work for unmanned aircraft operations	2013-present
DOE Pacific Northwest National Laboratory	Coastal wind profiler deployments in Oregon and Washington	2013-present
DOE Sandia National Laboratory	Precipitation sample collection during CalWater 2015	2015
DOE Sandia National Laboratory	Operational support for Oliktok Point Observatory	2015 (ongoing)
DOI/USGS North Central Climate Science Center	Collaborator on projects to incorporate climate science in ecological modeling	2012-present
DOI/USGS North Central Climate Science Center	Rangwala is a climate lead at NCCSC since Jan 2015; Have also been working on a NCCSC funded project in SW Colorado since 2013	2013-present
NASA Ames Research Center	Alpha Jet Experiment	2014-present
NASA Global Modeling and Assimilation Office	Joint research on atmospheric dynamics related to drought/extremes	2008-present
NASA Goddard Space Flight Center	Joint studies on Chemistry-Climate Interactions	2008-present
NASA Jet Propulsion Laboratory	CalWater 2015 collaboration with NASA ER-2	2014-present
NASA Jet Propulsion Laboratory	CalWater 2 and NASA Earth Venture Class suborbital proposal development	2011-present
NASA Jet Propulsion Laboratory	ENSO diversity working group activities	2012-present
NASA Langley	GOES observations over precipitation sampling sites	2012-present
National Drought Mitigation Center	Evaluation of the NIDIS ACF Drought Early Warning System	2014 -present

Organization	Activity	Dates
National Snow and Ice Data Center	Development of data harvesting strategies for Arctic data and metadata exchange; Advanced Cooperative Arctic Data Information Sharing	2012-present
Naval Research Laboratory	CalWater 2015 collaborative observations of air-sea exchange	2014-present
Naval Research Laboratory	Developing new parameterizations of stratospheric ozone and water vapor for NCEP global atmospheric models	2012-present
Pacific Northwest National Laboratory	ARM Cloud Aerosol and Precipitation Experiment (ACAPEX)	2011-present
U.S. Army Engineer Research and Development Center	Atmospheric acoustics	1999-present
U.S. Army Engineer Research and Development Center	Acoustic tomography of the atmospheric surface layer	2004-present
U.S. Army Research Laboratory	Sound propagation and scattering in a turbulent atmosphere	2002-present
U.S. Bureau of Reclamation	Develop Literature Review and Science Synthesis on efficacy of Winter Orographic Cloud Seeding	2014-2015
U.S. Bureau of Reclamation	Conduct research and develop products for use in evaluating dam safety	2011-present
U.S. Bureau of Reclamation	Expert consulting and collaboration on climate and water issues for the Colorado River	2008-2013
U.S. Bureau of Reclamation	Conduct research on climate variability and extremes for water resources	2008-present
USGS Climate Science Center	Climate-scale projections of reference ET	2015 (ongoing)

ACADEMIC/UNIVERSITY

Institution	Activity	Dates
Colorado State University	Develop new methods to improve QPE using advanced radar systems as well as operational radar systems	2009-present
Colorado State University	Data assimilation in reference ET reanalysis and bias correction of Forecast Reference ET	2015 (ongoing)
Columbia University	Examine anticipated changes in the statistics of weather and hydroclimate over western North America in coming decades from the point of view of needs in the management of water and ecosystems.	2013
Columbia University	Joint research on drought assessments and predictability	2012-present

Institution	Activity	Dates
Columbia University	Quantifying feedbacks and process for elevation dependent warming	2011-present
Columbia University	Collaborative field work on the influence of ocean waves and turbulence on air-sea transport of gases	2010-present
CSU	IN measurements of precipitation samples	2012-2014
Florida State University	Develop satellite-derived near-surface temperature and humidity product and associated heat flux products	2008-present
Georgia Institute of Technology	ENSO Diversity working group activities	2012-present
National Center for Atmospheric Research	Development of Evaporative Demand Drought Index	2015 (ongoing)
Naval Postgraduate School	Data assimilation in the Regional Arctic System Model	2012-present
Naval Postgraduate School	Sound propagation in a fluctuating ocean	2009-2013
Naval Postgraduate School	Joint Arctic observational & analysis projects	1997-present
NCAR	Joint studies on Africa climate/NAO variability	2002-2014
NCAR	Joint studies on Arctic mixed-phase clouds	2009-present
NCAR	Development of new State-of-the-Art pressure sensors	2014-present
NCAR	Air quality forecasting for ozone and PM2.5	2013-present
NCAR	20th Century Reanalysis Project, International Surface Pressure Databank	2010-present
NCAR	Conduct research on hydrometeorological flood simulation/prediction	2013-present
NCAR	Conduct research on hail in future climates in WRF simulations	2010-2012
NCAR	Joint work on National Climate Predictions and Projections Project	2012-2015
NCAR/MMM	Analysis of demographic changes in the atmospheric sciences, and of various means by which those data are acquired	2006-present
New Mexico State University	Sound propagation in the atmosphere	1996-2011
Oregon State University	Measurement of cloud microphysics with radar	2007-2015
Oregon State University	Greenland surface-atmosphere interactions	2013-present
Plymouth State University	CalWater 2015, Snow-level radar research, development of an AR portal	2013-present
Rutgers University	Quantifying feedbacks and process for elevation dependent warming	2005-present
Scripps Institution of Oceanography	Atmospheric river research , CalWater 2, western obs.	2008-present

Institution	Activity	Dates
Scripps Institution of Oceanography	CalWater 2015 collaborative observations of GPS meteorology	2014-present
Scripps institution of Oceanography	CalWater 2 and Alpha Jet Experiment	2011-present
Texas A&M University	ENSO diversity working group activities and 20th Century SODA reanalysis	2012-present
Texas A&M University	Simple Ocean Data Assimilation with Sparse Input, 20th Century Reanalysis	2008-present
Texas Tech University	Boundary layer remote sensors	2014-present
Uni. of CO/Civil and Environ. Engineering	Joint research on Indian Monsoon, Colorado River flow variability	2004-present
University at Albany	Collaborator on Chilean Coastal Orographic Precipitation Experiment (CCOPE)	2014-present
University of Connecticut	Air-sea flux measurement technology; wave effects	1990-2015
University of Miami	Boundary-layer cloud physics	1999-2015
University of Alaska	International working group to advance understanding of Arctic energy, moisture and gas fluxes; workshop planning	2013-present
University of Arizona	WRF Modeling and NOAA USWRP research proposal	2014-present
University of Arizona	ENSO diversity working group activities	2012-present
University of Arizona	Research on characteristics of climate expertise	2012-present
University of California Irvine	ENDO diversity working group activities	2012-present
University of California, Irvine	Hydrological modeling	2014-present
University of California, Los Angeles	HONO/Ozone titration during UBWOS 2012 and 2014	2013-2014
University of California, San Diego	CalWater precipitation chemistry research	2012-present
University of California, Santa Barbara	USAID/FEWs Net focused work on Africa climate variability/change	2010-present
University of California, Santa Barbara	Intraseasonal and interannual climate variability in South America	2001-present
University of Chicago	Joint studies on stratosphere-troposphere dynamical coupling	2009-present
University of Colorado	Development of the Regional Arctic System Model	2011-present
University of Colorado	Design of unmanned aircraft systems for operation in Arctic Environment	2013-present
University of Colorado	Joint studies on Arctic clouds and climate	2009-present

Institution	Activity	Dates
University of Colorado	Balancing Severe Decision Conflicts under Climate Extremes in Water Resource Management	2013-present
University of Colorado	Climate-Water-Electricity: Evaluating how climate change affects water availability and the future of the U.S. electricity sector	2013-2014
University of Colorado	Boundary layer remote sensors	2014-present
University of Colorado	Collaborate on developing a recreational transportation management tool targeting at All Terrain Vehicle (ATV) use.	2011-2012
University of Colorado	Soil moisture, snow depth and vegetation measurements using GNSS-R Interferometry	2008-present
University of Colorado	Development of GNSS-R bistatic radar for ocean wave measurements	2008-present
University of Colorado	CESM climate model performance over Greenland	2014-present
University of Colorado	International working group to advance understanding of Arctic radiation	2013-present
University of Colorado and NSF	Collaborate on CAMPS aircraft campaign in Colorado	2010-2011
University of Hawaii	ENSO diversity working group activities	2012-present
University of Hawaii	ENSO diversity working group activities	2012-present
University of Hawaii	Air-sea transport of trace gases, atmospheric chemistry and physics of marine aerosols	1992-present
University of Idaho	Collaboration on various Arctic research projects	2008-present
University of Illinois	Greenland surface-atmosphere interactions	2013-present
University of Maryland	Geostationary Remote Infrared Pollutions Sounder (GRIPS) development	2012-present
University of Miami	Co-chairs US CLIVAR working group on ENSO Diversity	2012-present
University of Michigan	Dust impacts on San Juan Mountains	2015 (ongoing)
University of Michigan	Development of wind speed retrieval algorithms for CYGNSS project	2011-present
University of Michigan	Joint work on National Climate Predictions and Projections Project	2012-2015
University of Nebraska	International working group to advance understanding of Arctic energy, moisture and gas fluxes	2013-present
University of Nevada Reno	Development of Evaporative Demand Drought Index	2015 (ongoing)
University of Texas	Boundary layer remote sensors	2014-present
University of Utah	Collaborate on StormVex campaign in Colorado	2010-2011

Institution	Activity	Dates
University of Washington	Hydrometeorological research focused on the Sierra Nevada	2010-present
University of Washington	Joint Arctic observational project	2013-present
Vanderbilt University	Joint project on clouds-atmosphere over Greenland	2010-present
Vanderbilt University	Greenland atmospheric research	2010-present
Washington State University	Joint project on clouds-atmosphere over Greenland	2010-present
Washington State University	Development of international working group to advance understanding of Arctic radiation	2013-present
Washington State University	Collaboration on various Arctic research projects	2007-present
Woods Hole Oceanographic Institution	Measurement of Air-sea fluxes from Flux Reference buoys	1991-2015
Woods Hole Oceanographic Institution	ENSO diversity working group activities	2012-present

REGIONAL AND LOCAL

Organization	Activity	Dates
Colorado Natural Heritage Program	Gunnison Climate Working Group	2009-2013
Cooperative Institute for Research in Environmental Sciences, (University of CO)	To conduct innovative research that advances our understanding of the global, regional, and local environments and the human relationship with those environments, for the benefit of society.	Ongoing
Cooperative Institute for Research in the Atmosphere (Colorado State University)	To conduct interdisciplinary research in the atmospheric sciences by entraining skills beyond the meteorological disciplines, exploiting advances in engineering and computer science, facilitating transitional activity between pure and applied research, leveraging both national and international resources and partnerships, and assisting NOAA, Colorado State University, the State of Colorado, and the Nation through the application of our research to areas of societal benefit.	Ongoing
Denver Water	Joint research into usability of climate information by water utilities; Front Range Climate Change Vulnerability Group	2008-present
Desert Research Institute	Development of Evaporative Demand Drought Index	2015 (ongoing)

Organization	Activity	Dates
Mountain Studies Institute Durango, CO	Climate science research and communication related to ecosystem resiliency in the San Juan Mountains and Four Corners region; including development of high school educational material related to climate change in mountain systems	2007-present
Southwest Research Institute, Boulder, CO	Development of end-to-end simulator for Cyclone GNSS (CYGNSS) project	2011-present
The HDF Group	Development of data harvesting strategies for Arctic data and metadata exchange	2012-present
The Nature Conservancy - Colorado	Climate science and risks communication and integration in conservation projects in the Upper Gunnison Basin	2013-present
Western Water Assessment	Climate Change in Colorado 2014 Report; Climate Scenarios in Landscape Conservation Design with Southern Rockies LCC	2013-present
Western Water Assessment	Studies on the interaction climate and multi-purpose reservoir management in several western reservoir systems, municipal water management and climate.	1998-present
Western Water Assessment	Assessment of hydrologic impacts of bark beetle and dust-on-snow on the Colorado River.	2012-present

COMMERCIAL

Company	Activity	Dates
AMEC	Expert consulting on Colorado water resources issues and climate; Colorado Climate Technical Advisory Group	Ongoing
AWS Truepower, LLC.	Improving wind forecasts	2011-present
Exelis	Development and maintenance of wavelet analysis website and software	1995-present
Remote Sensing Systems	Collaborate on ENSO precursors	
Riverside Technology, Inc.	Collaborate on developing the Community Hydrologic Prediction System - Flood Early Warning System (CHPS-FEWS) application for the Russian River and Napa River watersheds, California by providing calibrated input decks, forcing data, QPE retrieval automation codes, and various modeling consultancy.	2014
Science and Technology Corporation (STC)	Geostationary Remote Infrared Pollutions Sounder (GRIPS) development	2012-present
Science and Technology Corporation (STC)	Hyperspectral infrared soundings	2013-present
Scintec	Development of 915 MHz wind profiler technology	2013-present

Company	Activity	Dates
Stratus Consulting, Inc.	Joint research into usability of climate information by water utilities	2008-2013
Swiss RE, Inc.	Improving wind forecasts	2011-present
The HDF Group	Development of data harvesting strategies for Arctic data and metadata exchange	2012-present
Vaisala	Improving wind forecasts	2014-present
WindLogics, Inc.	Improving wind forecasts	2011-present

Sponsors

PSD receives more than half of its annual operating funds through sponsors, both from within and outside of NOAA. The primary sponsors of PSD's research are listed below by category in descending order of funds received over the last five years.

NOAA OFFICE OF OCEANIC AND ATMOSPHERIC RESEARCH

- Climate Program Office
- Geophysical Fluid Dynamics Laboratory
- Health of the Atmosphere Program
- National Integrated Drought Information Service
- Sandy Supplemental
- Unmanned Aircraft Systems
- U.S. Weather Research Program
- Wind Forecast Improvement Project

NOAA

- National Environmental Satellite Data Information Service
- National Marine Fisheries Service
- National Weather Service

OTHER-AGENCY

- California Department of Water Resources
- California Energy Commission
- Office of Naval Research
- Sonoma County Water Agency
- U.S. Agency for International Development
- U.S. Army Corps of Engineers
- U.S. Department of Energy
- U.S. Navy
- Vaisala Corporation

H. Field Projects



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PSD Field Programs

Field Program	Sponsoring Agency/Org	Scope	Description/Goal	PSD Role	PSD Principal Investigator(s)	Dates
Acoustic Tomography of the Atmosphere	ARO	Local	Build and operate the array of acoustic tomography of the ASL	Build and operate the array of acoustic tomography of the ASL	Ostashev, Wolfe	2010-present
ACSE (Arctic Clouds in Summer Experiment)	Stockholm University	International	Investigate clouds, atmospheric structure, surface energy budget, and related processes in variable sea-ice conditions of the Arctic Ocean	Contributed cloud radar, microwave radiometer, ceilometer, wind profiler, and other measurements. Engaged in process-based research.	Persson	2014
BAO (Boulder Atmospheric Observatory)	Various	Local, Regional	The Boulder Atmospheric Observatory (BAO) sits on 100 acres of land on the eastern plains of Colorado near the town of Erie. Its centerpiece is a 300m instrumented meteorological tower. The BAO has played a key part in numerous boundary layer studies and supports long-term climate baseline measurements. Associated studies have been reported in over 200 scientific publications and have included partnerships with local, state, and federal agencies, as well as university and commercial organizations.	Technical site support and program/project coordination for ground- and aircraft-base in-situ and remote sensor measurements.	Wolfe	Ongoing
CALNEX 2010	NOAA	National	Investigation of air pollution in the LA basin, the coast of California, and the Sacramento basin	Air-sea Flux and W-band radar cloud observations on the R/V Atlantis II	Fairall	2010
CalWater 2014	NOAA	National	Investigation of Atmospheric Rivers with NOAA G-IV aircraft	PI on the G-IV	Spackman, Fairall, White	2014
CalWater 2015	NOAA, DOE, NASA, NSF, ONR	Regional (West Coast US)	Aircraft-, ship-, and ground-based study of atmospheric rivers and the role of aerosols in cloud and precipitation processes	PSD scientists provided leadership roles as platform scientists, mission scientists, and forecast team members	Spackman, Fairall, White, Intrieri, Darby Gaggini, Wolfe Creamean	2015
CAMPS (Colorado Airborne Multi-Phase Study)	NSF	Regional	Investigate mixed-phase clouds and precipitation in an orographically forced region (Colorado).	Coordinate aircraft operations with a collaborative ground-based field project, oversee aircraft data analysis towards understanding spatial cloud structure and processes.	Shupe	2010-2011
COALA (Coordinated Observations of the Lower Arctic Atmosphere)	DOE	Local	Unmanned aircraft measurements of lower atmospheric thermodynamic state during sea ice freeze up	Operation and supply of unmanned aircraft, data preparation	de Boer	2014

Field Program	Sponsoring Agency/Org	Scope	Description/Goal	PSD Role	PSD Principal Investigator(s)	Dates
Denver-Julesburg Basin Air Quality Study	EDF, NOAA, NSF	Regional	To observe and characterize methane and non-methane hydrocarbon emissions from oil and natural gas operations in the Colorado Denver-Julesburg Basin	PSD deployed a network of wind profilers/RASS and surface meteorology sensors along the Colorado front range to support this major study led by NOAA/GMD during the spring/summer of 2012	White	2012
DYNAMO (Dynamics of the Madden-Julian Oscillation)	NOAA ONR NASA	International	Investigation of Madden-Julian Oscillation (MJO) in the Indian Ocean	FLux, sonde, and W-band radar measurements on R/V Revelle; flux observations from NOAA P-3	Fairall	2011-2012
FRAPPE (Front Range Air Pollution and Photochemistry Experiment) DISCOVER/AQ (Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality)	Colorado Department of Public Health, University of Colorado, Colorado State University, UC Berkeley, NASA, NOAA, NCAR	Regional	Characterize the local to regional chemical environment including photochemistry, oxidant and aerosol formation and fate, flow and recirculation patterns and large-scale inflow Provide cal/val data for Earth-observing satellites measuring air quality to help them distinguish between pollution high in the atmosphere and that near the surface where people live and breathe	PSD deployed a network of wind profilers/RASS and surface meteorology sensors along the Colorado front range to support these two major aircraft-based air chemistry field campaigns during the summer and early fall of 2014.	White	2014
HIWINGS (High Wind Gas Exchange Study)	NSF, NOAA	National	Investigation of air-sea trace gas fluxes in high wind speeds	Air-sea Flux and wave observations on the R/V Knorr	Fairall	2013
HMT (NOAA Hydrometeorology Testbed)	NOAA, CA-DWR, NASA	National	Observation-based process understanding and modeling research on high-impact regional precipitation, weather and land surface conditions. The applied research fosters transition of scientific advances and new tools into forecasting operations to better balance water resource demands and flood mitigation strategies in a changing climate.	HMT was managed by PSD. It is currently implemented at both PSD and NOAA's Weather Prediction Center. The observation-based process understanding research employs a variety of field instruments, including wind profiler, precipitation, and snow level radars, surface met, soil moisture and GPS-met.	White, Cifelli, Mahoney	Ongoing
HS3 (Hurricane and Severe Storm Sentinel)	NASA, NOAA	National	HS3 is a five-year mission specifically targeted to investigate the processes that underlie hurricane formation and intensity change in the Atlantic Ocean basin.	Operational, technical & engineering support of dropsonde syst. for Global Hawk. Real-time data provision to NWS & NHC.	Wick, Spackman, Jackson, Costa	2010-2014

Field Program	Sponsoring Agency/Org	Scope	Description/Goal	PSD Role	PSD Principal Investigator(s)	Dates
IASOA (Intl Arctic Systems for Observing the Atmosphere)	DOE, NSF, CANDAC, NOAA, Environment Canada, NILU, WMO, WCRP, ICSU, IOC	Regional, (Arctic)	To advance coordinated and collaborative research objectives from independent pan-Arctic atmospheric observatories through strategically developing comprehensive observational capacity, facilitating data access and usability through a single gateway, and mobilizing contributions to synergistic science and socially-relevant services derived from IASOA assets and expertise (http://www.esrl.noaa.gov/psd/iasoa/home2)	Program coordination, instrument deployments, Arctic measurements (air-sea-ice flux, boundary layer dynamics, clouds)	Starkweather, Uttal	Ongoing
ICECAPS (Integrated Characterization of Energy, Clouds, Atmospheric state, and Precipitation at Summit)	NSF DOE NOAA	International	Investigating the atmospheric state, clouds, and precipitation over the Greenland Ice Sheet and their influences on mass accumulation and surface energy budgets	Radar, lidar, precipitation, and radiosonde measurements. Process research.	Shupe	2010-present
Integrated Study of San Juan Basin Methane Emissions	NOAA	Regional (4-Corners)	Instrumented aircraft, mobile laboratory vehicle, and ground-based observations investigation of the source of a recently published US methane anomaly viewed from space.	PSD deployed wind profilers and Radio Acoustic Sounding Systems (RASS) to better constrain boundary layer winds, vertical temperature profiles, boundary layer thickness)	White	2015
MC3E (Midlatitude Continental Convective Clouds Experiment)	DOE, NASA	National	Observed convective cloud lifecycle to help parameterize precipitation processes in weather models and improve satellite rainfall estimates	Deploy and operate 449-MHz and S-band vertically pointing Doppler radars; analyze collected datasets.	Williams	2011
RV Mirai Arctic Mission 2014	JAMSTEC, NOAA	International	Obtain surface fluxes in open waters of Beaufort/Chukchi Seas during autumn	Provided surface flux instrumentation, including sonic anemometers and radiometers. Mounted them on the bow of the Japanese ship Mirai. Had CIRES/PSD staff maintain equipment during 6 week cruise.	Fairall	2014
San Juan Mountain Seed Study	UM, NASA	Local	Investigate impacts of dust aerosols on cloud and snow formation in the San Juan Mountains of Colorado	Collect aerosol and snow samples	Creamean	2015

Field Program	Sponsoring Agency/Org	Scope	Description/Goal	PSD Role	PSD Principal Investigator(s)	Dates
Sea State	ONR	National	Improve understanding of roles of waves during ice expansion.	Obtain data on surface energy fluxes, waves, atmospheric boundary layer, and ice conditions in the marginal ice zone during autumn freeze-up.	Fairall	2015
SHOUT (Sensing Hazards with Operational Unmanned Technology)	NOAA	National	Quantify the significance of unmanned observations to high impact weather prediction through data impact studies using Observing System Experiments (OSE) using unmanned observations collected during prototype operational field missions and Observing System Simulation Experiments (OSSE) based on expected unmanned observing capabilities.	Project scientist; mission science support; operational, technical and engineering support of the Global Hawk dropsonde system	Wick, Jackson	2014-2016
StormVEx (Storm Peak Cloud Properties Validation Experiment)	DOE	Regional	Investigate mixed-phase clouds and precipitation in an orographically forced region (Storm Peak).	Oversee on-site operations of DOE equipment, communicate with coordinated aircraft, general mission planning, and data analysis.	Matrosov, Shupe	2010-2011
SWERUS-C3/ACSE Swedish-Russian-U.S. Arctic ocean Investigation of Climate Cryosphere Interactions/Arctic Clouds in Summer Experiment)	University of Stockholm, NOAA	International	Collect data to improve understanding of clouds, boundary-layer structure, and air-ice/air-ocean interactions in the marginal ice zone	CIRES members of PSD provided cloud and boundary-layer observations with remote sensors and had 4 scientists/engineers on board the Swedish icebreaker Oden for 3 months; NOAA/PSD provided instrumentation	Persson	2014
TORERO (Tropical Ocean Tropospheric Exchange)	NSF, NOAA	International	Measurements of volatile organics in the equatorial Pacific	Air-sea flux measurements of carbon monoxide	Fairall	2012
UBWOS (Uinta Basin Winter Ozone Studies)	UIMSSD, Western Energy Alliance, Questar, Energy Products, BLM, NOAA, EPA, Environment Canada, DEQ	Regional (Uinta Basin, UT)	UBWOS was initiated in the first quarter of 2012 to identify the emissions sources and the unique photochemical processes that cause elevated winter ozone concentrations, and to identify the most effective strategies to reduce winter ozone. UBWOS included measurements of ozone and ozone precursor concentrations and meteorological conditions throughout the Basin.	Provided tall tower measurements of surface fluxes, ground based measurements of net irradiance, standard surface meteorological variables	Zamora	2012-2014

Field Program	Sponsoring Agency/Org	Scope	Description/Goal	PSD Role	PSD Principal Investigator(s)	Dates
WFIP (Wind Forecast Improvement Project)	NOAA, DOE	Regional (Upper Midwest, TX)	Improve wind forecasts for wind energy applications through assimilation of new observations and through the development of improved model parameterization schemes	Deploy instrumentation, observe and understand meteorological processes, develop new physical parameterization schemes for numerical forecast models	Wilczak	2010-present
WFIP2 (Wind Forecast Improvement Project - 2)	NOAA, DOE	Regional (Pacific Northwest)	Improve wind forecasts for wind energy applications in regions of complex terrain through the development of improved model parameterization schemes	Deploy instrumentation, observe and understand meteorological processes, develop new physical parameterization schemes for numerical forecast models	Wilczak	2014-present
WHOTS (Woods Hole Oceanographic Institution Hawaii Ocean Timeseries Site) and STRATUS	NOAA	International	Climate observations: Flux reference buoy sites	Annual cruises to each site. Ship-buoy intercomparisons and air-sea fluxes at the Chilean and Hawaiian Flux Reference buoy sites	Fairall	2010-present
WISPAR (Winter Storms and Pacific Atmospheric Rivers)	NOAA	National	Initial demonstration of the research and operational applications of the Global Hawk unmanned aircraft to observe winter storms and Pacific atmospheric rivers	Mission scientist; dropsonde system operations; scientific data analysis	Wick, Spackman	2011
XPIA (Experimental PBL Instrumentation Assessment)	NOAA, DOE	Local (Boulder County)	Determine the applicability of new state-of-the art remote sensing instrumentation for wind energy	Deploy and test new remote sensing instrumentation at the NOAA Boulder Atmospheric Observatory (BAO) tall tower facility	Wilczak, McCaffrey	Ongoing

I. Research Products



**ESRL Physical Sciences Division
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PSD Research Products

PSD produces a wide range of research products that include observational data sets, display tools, analysis products, forecast, decision support and situational awareness tools, physical process model parameterization, assessments, model outputs, climate and weather analyses and reanalyses, etc. These products are available to research groups, academic institutions, operational entities across NOAA, commercial organizations, decision makers and the general public. In large part they can be accessed via the PSD website (<http://www.esrl.noaa.gov/psd/>). A representative sample is shown below.

Product	Description	Users	Benefits/Impacts	PSD Contact
20th Century Reanalysis version 2 (1871-2012) and 2c (1851-2011)	Global reconstruction of weather every six hours from the surface of the earth to the tropopause back to 1851	Broad community including research scientists, students, economists, historians, national met services, US Army Corp of Engineers, wind energy industry, reinsurance industry	Provides first global weather reconstruction with quantified uncertainties back to the 19th Century	Gilbert Compo
A spatially comprehensive, daily hydrometeorological data set for Mexico, the conterminous U.S., and southern Canada: 1950-2013.	A ~ 6km gridded product (1/16 degree) of station observed precipitation, maximum and minimum daily temperature and derived hydrologic states and fluxes	Broadly applicable for downscaling studies, water balance studies, and for driving models	Provides a high resolution characterization of meteorology for a multi-decadal period and hydrologically-relevant horizontal resolution	Ben Livneh
All digital automated frost/heat forecast system	Utilizes real-time vineyard observations to bias correct numerical model and model statistical output to forecast from 1 to 5 days out the occurrence of frost or heat at each vineyard.	Sonoma County Water Agency, Western Weather Group, Fox Weather, Sonoma County Winegrape Commission, Mendocino Winegrape, Commission	Improved frost/heat forecasts to improve water resource management within the Russian River Basin	David Reynolds
Arctic Summer Cloud Ocean Study - ASCOS (Cloud Database)	Cloud macro and micro-physical measurements and retrievals from a suite of Ka-band cloud radar, multi-channel radiometer, and ceilometer; obtained near 87 N during the month of August 2008	International Arctic researchers	Are being used to validate models and reanalyses in the Arctic, and to improve forecasting of sea ice	Ola Persson
Arctic Summer Cloud Ocean Study - ASCOS (Wind Profiler Database)	Wind profiles and backscatter from the only ship based 449 MHz wind profiler in the world. A platform made to fit on the Swedish icebreaker Oden makes this possible. Data collected near 87 N during the month of August 2008.	International Arctic researchers	Will be used to validate models and reanalyses in the Arctic, and to better understand air-ocean and air-ice interactions and provide sea-ice forecasts	Ola Persson

Product	Description	Users	Benefits/Impacts	PSD Contact
Assessments of the causes of high-impact weather events and regional climate trends	Utilize observational data and experiments with climate and hydrological models of different complexity to determine the physical factors that cause observed regional and seasonal climate trends and high-impact weather events.	Policy and decision makers, General public	Provide best available science regarding factors causing high-impact weather and climate related extremes to make informed decisions on how society should invest in critical infrastructure in risk-prone areas while ensuring resilience. (http://www.esrl.noaa.gov/psd/csi/)	Judith Perlwitz
Atmos. River Water Vapor Flux Tool	Combines observations of wind profiles and integrated water vapor (IWV) to measure the IWV flux in the controlling layer and compares to operational numerical weather prediction prior and future forecasts	NWS weather and river forecasters, water managers, research scientists	Improved situational awareness of how well operational models are portraying atmospheric river conditions and resulting orographic precipitation	Daniel Gottas
Atmospheric River Detection Tool	Automated objective software package to aid in the identification and characterization of atmospheric rivers to assist forecasters	NWS and science community	Improves ability to help identify potential threats of extreme precipitation	Gary Wick
CNRFC 6 hourly QPE/QTE at the HRAP resolution (Hydrologic Rainfall Analysis Project, ~4.7-km) XMRG dataset: 2011-2014	Four years of the California Nevada River Forecast Center (CNRFC) precipitation and temperature datasets with the XMRG (binary) format.	Hydrologic modelers who run the Hydrologic Laboratory - Research Distributed Hydrologic Model (HL-RDHM) and scientists in NWS/ Office of Hydrologic Development	The datasets are georeferenced and format converted. They can be used directly to drive the distributed hydrologic model to obtain distributed hydrologic states. These states will benefit the subsequent hydrologic predictions.	Chengmin Hsu
Database of Air-Sea Flux measurements	NOAA-PSD hosts a database of ship-based flux observations going back to 1992. Several synthesis files containing multiple cruises are included.	Researchers developing methods to produce global flux products from satellite observations. NWP and Climate model developers. Algorithm developers.	Direct observations of air-sea fluxes remains in the domain of campaigns executed by teams of experts. Reliable data from the open ocean are extremely sparse. Fluxes are difficult to simulate and verify in models.	Christopher Fairall
Evaporative Demand Drought Index (EDDI)	A drought monitoring and early warning tool. EDDI.	U.S. Drought Monitor, state climatologists, municipal water operators.	Provide early warning of incipient drought and monitoring of ongoing droughts.	Michael Hobbins

Product	Description	Users	Benefits/Impacts	PSD Contact
Facility for Climate Assessments (FACTS)	A 25TB data set of global historical climate simulations with multiple models spanning 1871-present, different forcing streams, large ensemble. Capabilities to visualize, intercompare online with OBS and among models, download data.	Broad community, including academia, research scientists.	Rapid and near real-time capability to assess physical factors causing climate conditions through time.	Don Murray
Fairall-Banner sea-spray flux algorithm	A set of computer codes that allow estimation of air-sea momentum, heat, and moisture fluxes at hurricane wind speeds. Accounts for the effects of sea spray.	NCEP, Navy, NASA, several Universities.	This algorithm allows a hurricane model to account for the thermodynamic and dynamic effects of sea spray on the surface interactions.	Christopher Fairall
Forecast Reference Evapotranspiration (FRET)	Bias-correction of FRET	Growers, agricultural outreach workers, irrigators.	Provide 1- to 7-day, CONUS-wide forecasts of reference ET, for more efficient irrigation scheduling.	Michael Hobbins
Global Ensemble Forecast System Reforecast Data Set and Derived Products	A 150 TB data set of global ensemble forecasts and a wide range of experimental forecast guidance based on these, including week-2 temperature and precipitation forecasts (for CPC), week +1 precipitation forecasts (for HPC and others), weeks +1 to +2 tornado forecasts (for SPC).	NWS and broader community	Improved forecasts through statistically post-processed guidance based on internally generated GEFS reforecasts; see http://www.esrl.noaa.gov/psd/forecasts/reforecast2/	Thomas Hamill
Global Ensemble Forecast System Reforecast Data Set and Derived Products	A 150 TB data set of global ensemble forecasts and a wide range of experimental forecast guidance based on these, including week-2 temperature and precipitation forecasts (for CPC), week +1 precipitation forecasts (for HPC and others), weeks +1 to +2 tornado forecasts (for SPC).	NWS and broader community	Improved forecasts through statistically post-processed guidance based on internally generated GEFS reforecasts; see http://www.esrl.noaa.gov/psd/forecasts/reforecast2/	Thomas Hamill

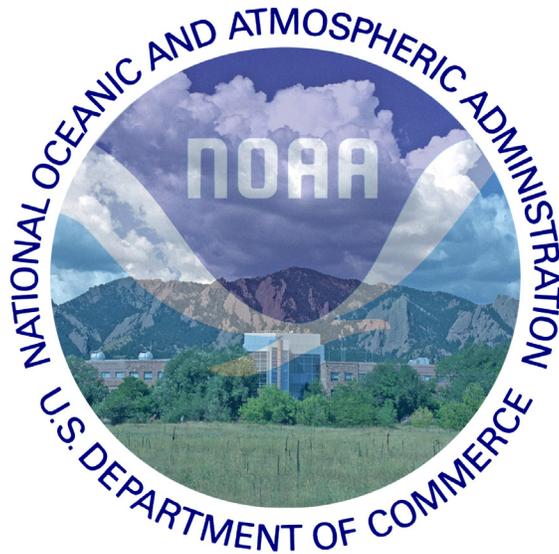
Product	Description	Users	Benefits/Impacts	PSD Contact
Hydrologic Model Performance Assessment Tool	A set of R codes for calculating the performance metrics of hydrologic modeling. The developed metrics include Nash-Sutcliffe Efficiency, Runoff Volume Difference, Modified Correlation Coefficient, Percent Bias, and Time to Peak. These functions can also automatically detect the miss of the USGS streamflow data to ensure the model assessment being executed on the apple-to-apple basis.	Modelers and forecasters	This tool allows modelers to evaluate their simulations right away after outputs are generated. The codes can also be compiled with C compiler and adapted into the hydrologic forecast system such as the CHPS-FEWS. This makes model diagnoses more efficiently and modelers easy to get the insights about model structure and parameters.	Chengmin Hsu
Integrated Characterization of Energy, Clouds, Atmospheric state, and Precipitation at Summit (ICECAPS) near-real time web page	Web page hosting near-real time measurements and data products from a suite of ground-based remote and in situ sensors characterizing the atmosphere, clouds, and precipitation at Summit Station on top of the Greenland Ice Sheet.	Arctic and Greenlandic climate researchers, operational forecasters, satellite algorithm developers, instrument developers	This tool provides near-real time insight into the conditions occurring over the Greenland Ice Sheet to facilitate research on a number of scales and for a number of international institutions and agencies. These observations also allow for process-level studies related to the mass and energy budgets of the Greenland Ice Sheet.	Matthew Shupe
International Surface Pressure Databank V3	The world's largest collection of pressure observations from 1856-2012. The ISPDv3 is a blend of many national and international collections of station, marine and tropical cyclone best track pressure observations.	NOAA, NASA, and International Reanalysis researchers.	Essential to providing an observational underpinning to retrospective climate analysis datasets. These Reanalysis products are used extensively in climate research, applications and services.	Gilbert Compo
MRMS NetCDF-XMRG Format Transformation Tool	A set of Python codes which can transform the 1-km resolution Multi-Radar Multi-Sensor (MRMS) QPEs between the NetCDF and XMRG format. The tool also possesses the capabilities to perform the geo-reference and aggregation functions.	Radar meteorologists and hydrologists	This tool makes radar data ready for hydrologic applications.	Chengmin Hsu
NOAA COARE bulk flux algorithm	A set of computer codes that allow estimation of air-sea or air-ice fluxes using bulk meteorological inputs. Meteorological and numerous trace gas fluxes are available.	NWP and Climate models, satellite flux products, Tao and Flux Reference buoys, ICOADS, blended flux products (WHOI OI, etc.).	Accurate and physically consistent flux estimates from simple inputs. Fit to 15,000 hours of direct measurements	Christopher Fairall

Product	Description	Users	Benefits/Impacts	PSD Contact
NOAA multi-generational reference ET reanalysis.	Generation-0 complete and loaded up to USGS GeoData portal, where it is available to researchers.	Researchers, USGS National Water Census.	Assist in drought monitoring; as a climatology for FRET; as an input to actual ET input to USGS National Water Census.	Michael Hobbins
OLR Madden-Julian Oscillation Index (OMI) along with Real-Time Version (ROMI)	An index of the state of the Madden-Julian Oscillation that utilizes satellite-derived Outgoing Longwave Radiation (OLR) only, available through the PSD Web Server	Broad community, including academia, research scientists, and the private sector	A real-time index of the MJO based only on OLR reflects the state of the MJO convective field and avoids the potential pitfalls of other indices which rely on circulation. The OMI and ROMI also take into account the two dimensional distribution of OLR throughout the seasonal cycle avoiding the need for averaging in latitude, more precisely determining the MJO state throughout the year.	George Kiladis
Reanalyses and observed Datasets made available for researchers		Researchers to general public	Tools and Data allow users to investigate climate and weather processes using a fixed model dataset. The datasets are 3-D and extend back as far as 1871.	Catherine Smith
Reanalyses.org collaborative reanalysis wiki page	The website is a tool to facilitate comparison between reanalysis and observational datasets. Evaluative content provided by reanalysis developers, observationalists, and users; and links to detailed data descriptions, data access methods, analysis and plotting tools, and dataset references are available. Discussions of the recovery of observations to improve reanalyses is also a focus. The wiki framework encourages scientific discussion between members of reanalyses.org and other reanalysis	NOAA, NASA, and international Reanalysis and related dataset developers, researchers. Also, NOAA teams and the NOAA Climate Reanalysis Task Force.	The tools greatly facilitates providing up-to-date reanalysis model information and access information as well as communication of research projects involving reanalysis among scientists. Registered users are from countries and institutions over the globe.	Gibert Compo
Snow-level product	A patented method to detect the level of the atmosphere where snow changes into rain.	NWS weather and river forecasters, water managers, research scientists	Verification of model forecasts. Important variable to determine how much of mountain basin will generate runoff	Allen White

Product	Description	Users	Benefits/Impacts	PSD Contact
Soil moisture and surface flux near-real time webpage	Webpage that allows users to display soil moisture, surface radiative, sensible, and ground heat fluxes, measured at NOAA Hydrometeorological Testbed observing locations.	Operational flood forecasters, water managers, fish habitat management, remote sensing developers, hydrological and meteorological model developers	Provides near-real time, and historical access to research quality observations of soil moisture and the surface energy balance.	Robert Zamora
Swedish-Russian-US Research Cooperation that Focuses on Climate-Cryosphere-Carbon - SWERUS-C3 Arctic Cloud Summer Experiment - ACSE (Cloud Database)	Cloud macro and micro-physical measurements and retrievals from a suite of instruments consisting of a W-band cloud radar, multi-channel radiometer, and ceilometer; obtained near 87 N during the month of August 2008	International Arctic researchers	Will be used to validate models and reanalyses in the Arctic, and to better understand air-ocean and air-ice interactions	Ola Persson
Tiksi, Russia Observatory near-real time webpage	Web page hosting near-real time measurements and data products from a suite of ground-based sensors characterizing the surface and lower atmosphere at Tiksi, Russia	Arctic weather/climate researchers, operational forecasters, satellite algorithm developers, instrument developers	This tool provides near-real time insight into conditions occurring in Tiksi, Russia to facilitate research on a number of scales and for a number of international institutions and agencies. These observations also allow for process-level studies related to surface energy fluxes and surface change.	Taneil Uttal
Vertical Profile Tool	Website allows users to extract different atmospheric products showing the vertical profile of the atmosphere. The products include single or multiple profiles on a date, a vertical transect between 2 points, a skew-T plot and a time by height plot. Data is extracted from different reanalyses and starts in 1871.	Model developers, researchers, weather enthusiasts	Provides access to historic weather information for researchers, those wishing to compare models and those looking at historic weather events.	Catherine Smith

Product	Description	Users	Benefits/Impacts	PSD Contact
Vertically Integrated Water Vapor Transport (IVT) GIS Tool	<p>A Python-based function which can automatically calculate water vapor transport at each pressure level and take integral of them. The domain covers the Pacific Ocean, Western US, and Southern Alaska.</p> <p>The tool is suitable for calculating IVTs for the variables extracted from the MERRA and NARR datasets.</p>	Research scientists, model developers, and forecasters	This tool facilitates the calculation of IVTs. It can benefit the identification of "Atmospheric River (AR)" phenomenon and can be used to quantify the interactive effects between ARs and topography.	Chengmin Hsu
WRIT: Web-based reanalysis IntercomparisonTools	A set of web tools for plotting maps and time series that allows users to compare reanalysis and observed datasets.	Research scientists, resource managers, universities	Provide information on how well reanalyses are doing for different regions, timescales and variables. That information can be used to improve models or determine which dataset to use in a research study. Allows user to quickly extract plots from reanalysis datasets.	Gilbert Compo

J. Research to Operations/ Applications



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PSD Research to Operations

PSD works closely with NOAA operational entities to transition selected research advances into NOAA operations. These transitions are often funded and progress carefully monitored. A representative sample is shown below.

Product	Description	Target Organization	Benefits/Impacts	TRL*	Transition Date	PSD Contact
Air Quality PM2.5 Post-Processing Algorithms	A set of codes to improve the skill of the NOAA/NCEP CMAQ air quality model for ozone and particulate matter forecasts through application of analog and Kalman filter post-processing schemes	NWS/NCEP Environmental Modeling Center	Post-processing of PM2.5 forecasts greatly improves model forecast skill, and an automated analog post-processing scheme reduces the need for state and local air quality forecasters to apply their own subjective corrections to the model forecasts	9	2014-2015	Irina Djalalova
Automated Digital Frost Forecast System	Gridded frost and heat forecasts for Russian River basin, CA	NWS Western Region	Forecasts allow water agency to plan for reservoir releases to accommodate crop spraying to mitigate for frost/heat. Growers can augment storage ponds prior to event to mitigate drawn-downs in tributaries and mainstem Russian on frost days. Goal is to eliminate any fish strandings to restore endangered salmon species in Russian.	8	2014-2015	David Reynolds
C-LIM Tropical forecasts	Empirical model yielding forecasts (and a priori forecasts of forecast skill) for pentads (5-day running means) of tropical SSTs, OLR, and 200/850 mb winds, for forecast leads of 5-270 days.	NWS/NCEP Climate Prediction Center	CLIM will provide a nice complement and alternative for the forecast of anomalous tropical convection to that produced from purely physical models (i.e. CFS, etc.). CPC is already using the C-LIM to aid the NWS operational Global Tropics Hazards and Benefits Outlook prepared weekly at CPC, but also plans to use it as part of the upcoming experimental probabilistic Week 3-4 U.S. temperature and precipitation outlooks in the context of assessing the potential tropical - extratropical teleconnection.	6 -7	2015	Matthew Newman

Product	Description	Target Organization	Benefits/Impacts	TRL*	Transition Date	PSD Contact
Ensemble Kalman Filter Data Assimilation System	An ensemble-based data assimilation technique that incorporates flow-dependent estimates for forecast uncertainty. Became operational at NCEP in 2012.	NWS/NCEP Environmental Modeling Center	Improved accuracy of forecast initial conditions, which improves forecast skill	10	Implemented in NCEP operations May 2012, further improvements in subsequent upgrades.	Jeffrey Whitaker
Hydrometeorology Testbed Observations	Research observations collected throughout U.S., but most notably in CA	NWS Western Region	Provides real-time access to NWS offices, including RFC's with SHEF-encoding for situational awareness	7	2013-2015	Daniel Gottas
Reforecasts	Transition of global medium-range reforecast capacity	NWS/NCEP Environmental Modeling Center	Dramatically improved weather and weather-climate forecast guidance supported by reforecast data sets and their use in statistical post-processing.	7-9	Expect funding for transition in 2015-2017 timeframe	Thomas Hamill
Sea Surface Temperature Diurnal Warming Amplitude Estimates	Modeled global estimates of instantaneous SST diurnal amplitude based on NWP analyses for incorporation in operational Global SST analysis	NESDIS	Improved SST product accuracy enabled by correction for diurnal warming influences on individual satellite retrievals	7	NESDIS Algorithm Readiness Review scheduled for April 2015; product operationalization to follow	Gary Wick
Stochastic Parameterizations of Model Uncertainty	Improves the representation of model uncertainty in ensemble forecast, improving forecast reliability and analysis accuracy. Became operational in the EnKF DA system at NCEP in 2014.	NWS/NCEP Environmental Modeling Center	Improved reliability of forecast ensembles, improved analysis accuracy.	9	Implemented in NCEP operations in 2015 for the EnKF analysis cycle, preparing for implementation in the medium range global ensemble system in 2016.	Jeffrey Whitaker

*Technology Readiness Levels

TRL 1: SCIENTIFIC RESEARCH

- Basic principles have been observed and reported
- Essential characteristics and behaviors of systems and architectures have been described
- Descriptive tools are mathematical formulations or algorithms

TRL 2: APPLIED RESEARCH

- Technology concept and/or application formulated
- Theory and scientific principles are focused on specific application area to define the concept
- Characteristics of the application are described
- Analytical tools are developed for simulation or analysis of the application

TRL 3: PROOF OF CONCEPT

- Analytical and experimental critical function and/or characteristic proof-of- concept
- Active research and development is initiated with analytical and laboratory studies
- Demonstration of technical feasibility using breadboard or brassboard implementations that are exercised with representative data

TRL 4: COMPONENT VALIDATION

- Component/subsystem validation in laboratory environment
- Standalone prototyping implementation and test
- Integration of technology elements
- Experiments with full-scale problems or data sets

TRL 5: PROTOTYPE TESTING

- System/subsystem/component validation in relevant environment
- Thorough testing of prototyping in representative environment
- Basic technology elements integrated with reasonably realistic supporting elements
- Prototyping implementations conform to target environment and interfaces

TRL 6: TESTING IN AN END-TO-END ENVIRONMENT

- System/subsystem model or prototyping demonstration in a relevant end-to-end environment
- Prototyping implementations on full-scale realistic problems
- Partially integrated with existing systems
- Limited documentation available
- Engineering feasibility fully demonstrated in actual system application

TRL 7: DEMONSTRATION IN AN OPERATIONAL ENVIRONMENT

- System prototyping demonstration in an operational environment

- System prototyping demonstration in operational environment
- System is at or near scale of the operational system, with most functions available for demonstration and test
- Well integrated with collateral and ancillary systems. Limited documentation available.

TRL 8: SYSTEM DEVELOPMENT COMPLETED

- Actual system completed and “mission qualified” through test and demonstration in an operational environment
- End of system development
- Fully integrated with operational hardware and software systems
- Most user documentation, training documentation, and maintenance documentation completed
- All functionality tested in simulated and operational scenarios
- Verification and validation completed
- TRL 9: System Fully Operationally Integrated
- Actual system “mission proven” through successful mission operation
- Fully integrated with operational hardware/software systems
- Actual system has been thoroughly demonstrated and tested in its operational environment
- All documentation completed
- Successful operational experience
- Sustaining engineering support in place

K. Technology Transfer



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PSD Technology Transfer

Technology transfer formally refers to the transitioning of marketable technologies developed in the federal sector to private industry via the patent, license, and CRADA (Cooperative Research and Development Agreement) process. It is governed primarily by the Bayh-Dole Act of 1980 and the Technology Transfer Act of 1986, and is codified in Title 14 (Commerce and Trade). Chapter 162 (Technology and Innovation) of the United States Code.

PSD and its predecessor organizations (the NOAA Wave Propagation Laboratory and the NOAA Environmental Technology Laboratory) have a long history of technology transfer, with over 41 patents awards, six companies formed, and 18 product lines developed since the early 1970s. This activity has decreased substantially in recent years due to a shift in priorities away from broader technology development towards maintaining a more narrowly focused expertise in weather and climate science-based observations critical to the PSD mission.

PSD currently maintains five patents:

Wind Profiling Radar, # 5592171, Issued January 7, 1997

Operational Bright-Band Snow Level Detection Using Doppler Radar, # 6615140, Issued September 2, 2003

Combination N-Way Power Divider/Combiner and Noninvasive Reflected Power Detection, # 6753807, June 22, 2004

Detection of Transient Signals in Doppler Spectra, # 8022864, Issued September 20, 2001

and has two active licenses:

Wind Profiling Radar, Issued June 22, 2007

Operational Bright-Band Snow Level Detection Using Doppler Radar, Issued June 22, 2007

The licenses fall under a CRADA with Scintec Corporation (<http://www.scintec.com>), which is focused on the development and refinement of 915 MHz wind and temperature profiling technologies. This CRADA was recently transferred from Vaisala (<http://www.vaisala.com>), which held it for over 20 years. It has been extended through March 30, 2021. Short-term goals include a performance comparison between a legacy Vaisala profiler and a newer Scintec profiler to be carried out the Boulder Atmospheric Observatory (BAO) facility near Erie, CO. The focus is on ensuring interoperability and access by PSD scientists and engineers to new signal and post processing schemes and other system outputs so that they can be evaluated and potentially improved.

L. Education



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PSD Education Activities

Instruction

PSD Staff	Institution	Department	Course(s)	Dates
Michael Alexander	University of Colorado, Boulder	ATOC	Oceanography Seminar	8/2012-12/2012
Michael Alexander	University of Colorado, Boulder	ATOC	Physical Oceanography	Multiple individual classes, 2010-2015
Alfred Bedard	University of Colorado	Engineering School Teach for Aero and ME Departments	Piloted a new design course in the 1990's with a small section of students. Half of the CU engineering students now take this course, which has increased retention rates, particularly for female and minority students.	1994 to current GEEN1400
Gijs de Boer	University of Alaska, Fairbanks	International Arctic Research Center	Summer school on modeling of the Arctic climate system	Summer 2011
Chengmin Hsu	University of Colorado, Denver	Civil Engineering	GIS Analyses (CVEN 5383): Instruction for the sections of "Python Programming" & "Spatial Statistics"	Feb. 2011 - Mar. 2011
Mimi Hughes	University of Colorado, Boulder	Atmospheric and Oceanic Sciences	Introduction to Weather and the Atmosphere	Fall 2014
Ben Livneh	University of Colorado, Boulder	Civil Engineering	Summer course on hydrologic modeling	2013-2014
Kelly Mahoney	University of Colorado, Boulder		Water in the Western US	April 2015 (1 video lecture)
Don Murray	Chinese Meteorological Administration Training Center		Second International Training Course on Regional Climate Prediction and Drought Monitoring	October 14-18, 2013
Ola Persson	University of Colorado	CIRES	K-12 teacher education workshop on Arctic processes	2/22/2014
Amy Solomon	NOAA	NOAA Barrow Observatory/Illisagvik Tribal College	STEM Camp	Summer 2013
Amy Solomon	University of Colorado, Boulder	Atmospheric and Oceanic Sciences	Graduate seminar on polar climate	Fall 2014
De-Zheng Sun	University of Colorado	ATOC	Climate Dynamics	Fall 2012
James Wilczak	European Union COST Action		Summer school on forecasting for renewable energy	2014
Daniel Wolfe	University of Colorado, Boulder	Geography	Climatology	4/4/2013
Daniel Wolfe	University of Colorado, Boulder	Geography	Climatology	4/8/2014

PSD Staff	Institution	Department	Course(s)	Dates
Daniel Wolfe	University of Colorado, Boulder	Geography	Climatology	4/1/2012
Valery Zavorotny	University of Colorado, Boulder	Aerospace Engineering Department	Seminar class ASEN 5270: Progress in remote sensing using GNSS reflections	4/16/2014
Valery Zavorotny	University of Colorado, Boulder	Aerospace Engineering Department	Seminar class ASEN 5270: Remote sensing using GNSS bistatic radar of opportunity	4/1/2015

Mentorship

PSD Staff	Student Name	Institution	Relationship	Dates
Michael Alexander	Laurie Trenary	University of Colorado	PhD Committee member	2010-2013
Michael Alexander	Jian Zheng	Ocean University, China	Hosted as a visiting scholar	2011-2013
Michael Alexander	Jiangling Yang	Ocean University, China	Hosted as a visiting scholar	3/2014-9/2014
Michael Alexander	Hillary Scannell	University of Maine	Masters Committee member	2014-2015
Michael Alexander	Richard Batemen	University of Colorado	PhD Committee member	2015
Robert Cifelli	Delbert Willie	Colorado State University	PhD Committee Member	2012-2015
Gijs de Boer	Nathaniel Miller	University of Colorado	PhD Committee Member	2014-present
Gijs de Boer	Tevis Nichols	University of Colorado	PhD Committee Member	2015-present
Barbara DeLuisi	Robert Hart	Metro State	Technical Advisor	Summer/Fall 2011
Barbara DeLuisi	Irfan Nadiadi	University of Colorado	Mentor	Summer 2011
Henry Diaz	Lauren Kaiser	University of Hawaii, Manoa	Masters Committee member	2013-2014
Henry Diaz	Ryan Longman	University of Hawaii, Manoa	PhD Committee Member	2013-2015
Henry Diaz	Abby Frazier	University of Hawaii, Manoa	Masters Committee member	2012-2014
Henry Diaz	Lauren Kaiser	University of Hawaii, Manoa	Masters Committee member	2013-2014
Christopher Fairall	Elizabeth Thompson	Colorado State University	PhD Advisor	2012-present
Christopher Fairall	Katherine McCaffrey	University of Colorado	PhD Advisor	2010-2014
Christopher Fairall	Alice Duvivier	University of Colorado	PhD Advisor	2011-present
Christopher Fairall	Patrick Boylan	University of Colorado	PhD Advisor	2010-2014
Thomas Hamill	Francisco Alvarez	St. Louis University	Ph.D. Committee Member	2012-2015

PSD Staff	Student Name	Institution	Relationship	Dates
Leslie Hartten	Aaron Piña	Texas A&M University	Research Mentor, UCAR's SOARS Program	Summer 2010
Leslie Hartten	Javier Lujan	University of Texas - El Paso	Research Mentor, UCAR's SOARS Program	Summer 2011
Leslie Hartten	Ma'Ko'Quah Jones	Dartmouth College	Research Mentor, UCAR's SOARS Program	Summer 2012
Leslie Hartten	Adrianna Hackett	University of Colorado	Writing and Communi- cations Mentor, UCAR's SOARS Program	Summer 2013
Leslie Hartten	Paola S. Esteban Pérez	Colegio San José, Cajica, Columbia	Science Mentor, NCAR's Pre-College Internship Program (PRECIP)	Summer 2014
Leslie Hartten	Valerie M. Rodriguez Castro	University of Puerto Rico - Mayaguez	Science Mentor, NCAR's Pre-College Internship Program (PRECIP)	Summer 2015
Michael Hobbins	Daniel McEvoy	University of Nevada Reno	PhD Committee Member	2014-present
Michael Hobbins	(MS student of Prof. Jorge Ramirez)	Colorado State uni- versity	MS Committee Mem- ber	Start spring, 2015
Martin Hoerling	Colin Kelly	Columbia University	PhD Committee Member	2013-2014
Mimi Hughes	Samuel Elliott	University of Colorado	Advisor (undergradu- ate research)	2014-present
Mimi Hughes	Lee Fordyce	University of Colorado	Advisor (undergradu- ate research)	2011-2014
Paul Johnston	Paola S. Esteban Pérez	Colegio San José, Cajica, Columbia	Science Mentor, NCAR's Pre-College Internship Program (PRECIP)	Summer 2014
Paul Johnston	Valerie M. Rodriguez Castro	University of Puerto Rico - Mayaguez	Science Mentor, NCAR's Pre-College Internship Program (PRECIP)	Summer 2015
George Kiladis	2 students	Colorado State Uni- versity	PhD Thesis Committee Member	2014-present
George Kiladis	3 students	State University of New York at Albany	PhD Thesis Committee Member	2012-present
George Kiladis	1 student	Courant Institute of Mathematical Sciences, New York University	PhD Thesis Committee Member	2012
George Kiladis	1 student	University of Victoria, British Columbia	PhD Thesis Committee Member	2011
George Kiladis	1 student	University of California, Santa Barbara	PhD Thesis Committee Member	2014-present
David Kingsmill	Raul Valenzuela	University of Colorado	PhD Advisor	2012-present

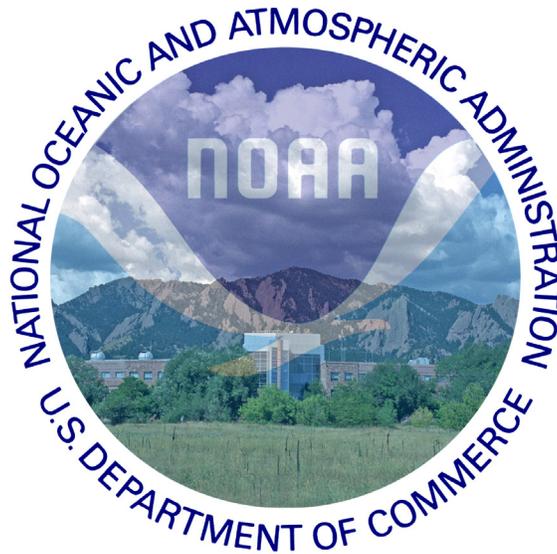
PSD Staff	Student Name	Institution	Relationship	Dates
Ben Livneh	Elizabeth Houle	University of Colorado	Masters Committee member	2014-2015
Ben Livneh	Mas Yanto	University of Colorado	PhD Committee Member	2014-Present
Ben Livneh	Peter Shellito	University of Colorado	Masters Committee member	2014-2015
Ben Livneh	Dominik Schneider	University of Colorado	Masters Committee member	2012-2015
Kelly Mahoney	Jennifer Tate	North Carolina State University	Master Committee Member	2013 - 2015
William Neff	Behrens	University of Auckland	PhD Thesis Committee Member	2010
William Neff	Strehz	University of Auckland	PhD Thesis Committee Member	2014
William Neff	Van Dam	University of Colorado	PhD Thesis Committee Member	2011-2013
William Neff	Miller	University of Colorado	PhD Thesis Committee Member	2014-present
William Neff	Duvivier	University of Colorado	PhD Thesis Committee Member	2012-2015
Cecile Penland	Ma'Ko'Quah Jones	Dartmouth College	Research Mentor, UCAR's SOARS Program	Summer 2012
Judith Perlwitz	1 student	University of California, Davis	PhD Thesis Committee	2012
Robert Pincus	Peter Hill	University of Reading	External examiner	2013
Imtiaz Rangwala	Justin Briggs	Stanford	Research Mentor	Summer 2010
Imtiaz Rangwala	Jessica Johnstone	Front Range Community College	Mentor, CIRES RECCS undergraduate summer internship	Summer 2014
Andrea Ray	Deanna Metivier	North Carolina State Univ...	Research Mentor, RESESS program with goal of increasing the diversity of students entering the geosciences. RESESS.unavco.org	Summer 2015
Matthew Shupe	Ben Castellani	University of Colorado	Masters Advisor	2011-2014
Matthew Shupe	Nathaniel Miller	University of Colorado	PhD Advisor	2013-present
Matthew Shupe	Michael Stone	University of Colorado	PhD Advisor	2015-present
Matthew Shupe	Samuel Dorsi	University of Colorado	Post-Doc Advisor	2013-2014
Amy Solomon	1 student	NOAA HIRO Program	Science Mentor	2011
James Wilczak	Rogier Floors	Danish Technical University	PhD Committee Member	2013
Robert Zamora	Andrea Thorstensen	St. Cloud State	NOAA Hollings Scholar	Summer 2010
Robert Zamora	Timothy Lahmers	California University of Pennsylvania	NOAA Hollings Scholar	Summer 2011

PSD Staff	Student Name	Institution	Relationship	Dates
Robert Zamora	Joseph Dougherty	Rose–Hulman Institute of Technology		Summer 2011
Robert Zamora	Kaethe Pheiffer	Rose–Hulman Institute of Technology		Summer 2011
Robert Zamora	Lucas Avery	Dennison University		Summer 2011
Robert Zamora	Charles Shobe	William and Mary	NOAA Hollings Scholar	Summer 2012
Robert Zamora	Carlos Sandoval	University of Colorado		Summer 2014
Valery Zavorotny	2 students	University of Colorado, Boulder	PhD Thesis Committee Member	2013-2015

Appointments

PSD Staff	Institution	Title	Role	Dates
Michael Alexander	University of Colorado, ATOC department	Adjunct Faculty	Teach classes, advise students	7/2102-present
Alfred Bedard	University of Colorado	Adjunct Associate Professor Aerospace Engineering Sciences Department 1980 to present	Teach courses and advise students	Current
Alfred Bedard	University of Colorado	Adjunct Associate Professor Mechanical Engineering Department 2014 to present	Teach courses and advise students	Current
Randall Dole	Cornell University	Advisory Board, Earth and Atmospheric Sciences	Member	2008-present
George Kiladis	Colorado State University	Affiliate Faculty Member	Member	2014-present
Ben Livneh	CU-Boulder	Faculty Mentoring Students	Faculty Mentor	2013 - 2014
Kelly Mahoney	North Carolina State University	Adjunct Faculty	Advise students, graduate committee member	2013 - present
Andrea Ray	University of Colorado Environmental Studies	Adjunct	Advise students, guest lectures	2010-present
Ryan Spackman	Scripps Institution of Oceanography, University of California San Diego	Research Associate	Collaborative research on airborne field studies	2014 - present

M. Outreach and Communications



**ESRL Physical Sciences Division
Science Review
May 12-14, 2015**

PSD Outreach and Communications Activities

Name	Type	Activity/Title/Name	Outlet/Location	Date
Michael Alexander	Internal	Presented talks entitled "Climate models and climate scenarios" and "The General Climate response along the east coast of North America"	National Marine Fisheries Service's (NMFS), Northeast Region's (NERO) Protected Resources Division Climate Change Workshop	7/16/2012
Joseph Barsugli	Outreach	FEMA Colorado Resilience Working Group	Denver, CO	
Joseph Barsugli	Training	COSEE West Secondary School Science Teacher Training on Climate Change	Boulder, CO	Summer 2012, 2011
Joseph Barsugli	Outreach	Front Range Climate Change Vulnerability Working Group; presentations on climate modeling for water managers	Colorado	2008-ongoing
Alfred Bedard	Outreach	On the Board of Directors for the Colorado State Science and Engineering Fair representing NOAA (Past President)	Colorado	Current
Alfred Bedard	Outreach	Judge at the Colorado Science and engineering fair for the DOC internship award	Colorado	Current
Alfred Bedard	Outreach	Judge at the Colorado Science and engineering fair for the NOAA Pulse of the Planet award	Colorado	Current
Alfred Bedard	Outreach	Assisting a Senior Design Team at the University of Colorado with their project to measure low-frequency sound waves from a high-altitude balloon.	Colorado	Current
Antionietta Capotondi	Media	Interviewed for Nature Climate Change News and views "Extreme La Nina events to increase"	Linda Carroll, NBC News	1/21/2015
Antionietta Capotondi	Media	Interviewed for Nature Climate Change News and views "Extreme La Nina events to increase"	Brian Kahan, Climate Central	1/21/2015
Antionietta Capotondi	Media	Interviewed for Nature Climate Change News and views "Extreme La Nina events to increase"	Warren Cornwall, National Geographic	1/26/2015
Antionietta Capotondi	Resource	Invited panel member for evaluating the NCAR CAM5.5	NCAR, Boulder, CO	10/2014 to present
Antionietta Capotondi	Resource	Co-chair, US CLIVAR working group on ENSO Diversity		2012-present
Antionietta Capotondi	Training	HMT-SEPS Data and Model Forecast Training Webinar	NOAA, Boulder, CO	7/31/2013
Gilbert Compo	Outreach	Curator, Science on a Sphere dataset, Precipitable Water - Antarctic Expedition - 1902 - 1903	NOAA/ESRL, Boulder, CO	7/1/2014

Name	Type	Activity/Title/Name	Outlet/Location	Date
Gilbert Compo	Outreach	Curator, Science on a Sphere dataset, Precipitable Water - El Nino - 1917 - 1919	NOAA/ESRL, Boulder, CO	7/1/2014
Gilbert Compo	Outreach	Curator, Science on a Sphere dataset, Precipitable Water - Galveston Hurricane - 1900	NOAA/ESRL, Boulder, CO	7/1/2014
Gilbert Compo	Media	Interviewed for "The Weather isn't getting weirder," Wall St. Journal opinion	Wall Street Journal	2/10/2011
Gilbert Compo	Media	Letter to the editor "Severe weather is driven by many factors"	Wall Street Journal	2/23/2011
Gilbert Compo	Media	Interviewed for "Old Weather is Shedding New Light on Climate"	Climate Central	2/4/2011
Gilbert Compo	Media	Interviewed for "Old ship logs fill in weather history of past 250 years"	USA Today	11/25/2010
Gilbert Compo	Media	Interviewed for "CU-Boulder-led study confirms warming without thermometers"	Daily Camera	4/11/2013
Gilbert Compo	Media	Interviewed for "New Method Proves Again Climate Change Is Real"	Scientific American	4/10/2013
Gilbert Compo	Media	Interviewed for Podcast "Powering the 20th Century Weather Reanalysis Project"	HPCwire Soundbite	3/10/2014
Gilbert Compo	Outreach	8th grade advanced science lecture on global warming and reanalysis	Louisville Middle School, Louisville, CO	4/4/2013
Gilbert Compo	Resource	Email support of software for wavelet analysis - about 5 emails a month from students and researchers	University of Colorado, Boulder, CO.	1998 to present
Gilbert Compo	Internal	NOAA Climate Program Office MAPP Webinar	Webinar	6/4/2014
Gilbert Compo	Decision/Policy Makers	National User Facility Organization Exhibition to Congress. Briefed congressional staff members and representatives, including Senator Feinstein staff and Colorado Springs representative Doug Lamborn on the 20th Century Reanalysis.	Washington DC	4/11/2011
David Costa	Internal	70 Seconds of Science The Vital Role of Engineers.	DSRC Boulder, CO	
Christopher Cox	Public Outreach	Public Lecture	Barrow, AK	10/1/2013
Lisa Darby	Outreach	Developed and presented a water allocation game for elementary school-aged summer camp kids (other PSD presenters included B. DeLuisi and J. Intrieri)	Boulder, CO	August 2014
Gijsde Boer	Outreach	Public Lecture	Barrow, AK	4/1/2013
Gijs de Boer	Outreach	Elementary and High School visit	Barrow, AK	4/1/2014
Barbara DeLuisi	Public Outreach	Annual 8th Grade Science Day Event	NOAA, Boulder, CO	2010-present
Barbara DeLuisi	Public Outreach	Bring Your Child to Work Day Event	NOAA, Boulder, CO	April 2010

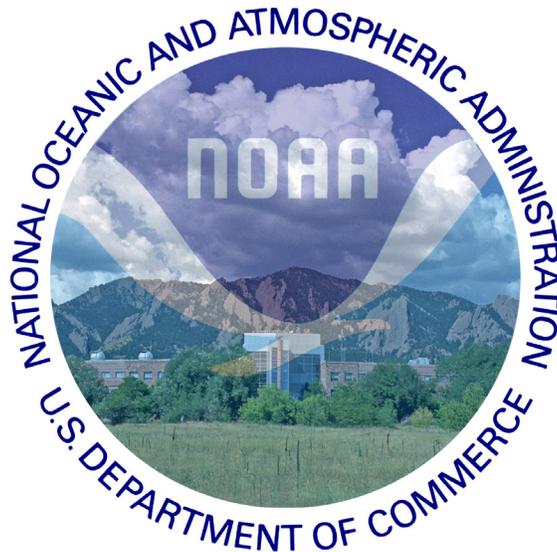
Name	Type	Activity/Title/Name	Outlet/Location	Date
Barbara DeLuisi	Public Outreach	Earth Day Event	NOAA, Boulder, CO	2011-2012
Barbara DeLuisi	Public Outreach	Boulder County Fair Super Science Day - Activities for Kids	Longmont, CO	2012-2014
Barbara DeLuisi	Public Outreach	Denver Public Schools Career Day - Exhibit Booth	Denver, CO	2012 and 2014
Barbara DeLuisi	Public Outreach	Colorado Science Teachers Convention - Exhibit Booth	Denver, CO	
Christopher Fairall	Outreach	Presentation for CU/CIRES/COSEE program for teachers	Boulder, CO	2009
Christopher Fairall	Outreach	Hosted NOAA Teacher-in-the-Lab	NOAA, Boulder, CO	2009
Leslie Hartten	Public Outreach	Science Fair Judge	Eisenhower Elementary, Boulder, CO	Feb. 2010, April 2012, Nov. 2012, Nov. 2013, Feb. 2015
Leslie Hartten	Public Outreach	30-minute Weather Briefing	Internet2 Global Summit Annual Meeting, Denver, CO (Note: Internet2 is one of NOAA's partners in the N-Wave and X-Wave network programs)	4/10/2014
Leslie Hartten	Internal	Presenter Daily Weather Briefing	NOAA/ESRL, Boulder, CO	Ongoing, about 2x/month
Chengmin Hsu	Resource	Creation of the user guide for operating the distributed hydrologic model in the Community Hydrologic Prediction System-Flood Early Warning System (CHPS-FEWS)	ESRL, Boulder, CO	5/12/2014 - 5/23/2014
Mimi Hughes	Outreach	Elementary school science fair	Campbell elementary, Arvada, CO	March 2013, March 2014, March 2015
Darren Jackson	Outreach	Elementary school visits regarding water cycle	Prospect Ridge Academy, Broomfield, CO	2012-2014
Paul Johnston	Outreach	Guest Lecture on radars with emphasis on Snow Level Radars	Plymouth State University Meteorology Department	11/20/2014
David Kingsmill	Public Outreach	Exhibit Development with Exploratorium	San Francisco, CA	2010-present
David Kingsmill	Outreach	Guest lecture on orographic precipitation	University of Colorado	11/11/2014
Kelly Mahoney	Outreach	Invited panelist, National Science Foundation Atmospheric and Geospace Sciences Post-Doctoral Fellowship Workshop Career Panel: "Post Post-Doc: What Are The Next Steps and Ways Forward?"	NCAR, Boulder CO	4/1/2013
Kelly Mahoney	Outreach	Invited panelist, CIRES "Think Outside the Lab; Six Exciting Alternative Careers in Science."	University of Colorado, Boulder, CO.	3/6/2013
Kelly Mahoney	Outreach	Boulder Valley School District NOAA Science Days Presenter: 2013 Front Range Flood: Was it a 100-year Storm?	NOAA/ESRL, Boulder, CO	2/14/2014

Name	Type	Activity/Title/Name	Outlet/Location	Date
Kelly Mahoney	Outreach	Invited panelist, Severe Flooding on the Colorado Front Range: Flood Expert Panel and Community and Media Outreach	CIRES, CU Boulder CO	9/25/2013
Kelly Mahoney	Media	Many interviews via television, radio, online, newspaper outlets regarding 2013 Front Range floods	Various including: National Geographic; The Weather Channel; ClimateWire; Reuters; Colorado Public Radio; Boulder Daily Camera, Denver Post; many other local news outlets (radio, TV, and newspapers)	
Kelly Mahoney	Media	Many interviews regarding HMT-Southeast field study	Various including: North Carolina Associated Press; High Country News; many other local news outlets (radio, TV, and newspapers)	
Katherine McCaffrey	Outreach	NCAR CGD seminar	NCAR, Boulder, CO	Sept 2014
Katherine McCaffrey	Outreach	CO Science and Engineering Fair Grand Awards Judge	CSU, Fort Collins, CO	4/1/2015
Donald Murray	Public Outreach	Annual 8th Grade Science Day Event	NOAA, Boulder, CO	
Donald Murray	Outreach	SOS visualizations on atmospheric rivers and drought	AMS Annual Mtg.. Phoenix, AZ	
Matthew Newman	Media	Interviewed for "Extreme El Niños to become more frequent with climate change -- study"	Climate Wire	1/21/2014
Matthew Newman	Media	Interviewed for "Wedge of warm seawater known as 'the blob' blamed for marine havoc"	LA Times	4/15/2015
Matthew Newman	Internal	Is the PDO a Useful Predictor of North American Climate?	NWS Climate Services Division Seminar Series	7/10/2013
Matthew Newman	Outreach	Presentation: "Pacific Decadal Oscillation and why should you care?"	MDA Weather Services Annual Energy Conference	11/29/2012
Imtiaz Rangwala	Outreach	Webinar & Newsletter	Boulder, CO	Oct 2014
Imtiaz Rangwala	Outreach	Science and Filmmaking Outreach with Earth Explorers	Westview Middle School, Longmont, CO	Spring 2014
Imtiaz Rangwala	Outreach	High school climate change curriculum development	Mountain Studies Institute, Durango & Silverton, CO	2012-2014
Imtiaz Rangwala	Outreach	Reviewer and advisor; Climate change report prepared for the city of Aspen, Colorado	Aspen Global Change Institute, Aspen, CO	2013-2014
Imtiaz Rangwala	Outreach	Member and contributor to a "A Global Campaign to Understanding Elevation Dependent Warming (EDW)"	Mountain Research Initiative, Switzerland	Ongoing since 2013
Andrea Ray	Training	Climate expert on the teaching team for the pilot course for on "Addressing Climate-related Uncertainty in Natural Resource Management," a joint effort between NOAA, FWS & USGS	USFWS National Conservation Training Center, Shepherdstown, WV	2/1/2013

Name	Type	Activity/Title/Name	Outlet/Location	Date
Andrea Ray	Outreach	Host for University of Chicago Career Trek; ~30 students visited NOAA	NOAA/ESRL, Boulder, CO	12/11/2011
Matthew Shupe	Outreach	Elementary and High School presentations on Arctic research	Chinook West & Nederland Elementary	2011-2014
Matthew Shupe	Outreach	Guest lectures	University of Colorado	Nov 2014
Catherine Smith	Outreach	Presented Colorado weather information to classes at an elementary school	Boulder, CO	Apr 2013, Sep 2014
Ryan Spackman	Media	AGU Press Workshop: Refilling California's reservoirs – the storm/aerosols connection	AGU Fall Meeting, San Francisco, CA	12/18/2014
Ryan Spackman	Media	CalWater 2015 Media Coverage: Interviews with television, radio, and newspapers including co-leading Media Day on 3 Feb 2015	LA Times, CBS This Morning, NBC National, Denver Post, NPR Science Friday, Southern California Public Radio, KQED Public Radio, Sacramento Bee, Wired Magazine, and other California TV news outlets	1/15 - 2/24/2015
Ryan Spackman	Media	CalWater 2014 Media Coverage: Interviews with Newspapers	San Jose Mercury News and other outlets	2/10/2014
Ryan Spackman	Media	CalWater 2015 Media Activities: Hosted LA Times reporter and CBS National Correspondent on NOAA P-3 aircraft research flights in atmospheric rivers during CalWater 2015	McClellan, CA	2/6 - 2/8/2015
Ryan Spackman	Public Outreach	Calwater 2014/2015 Outreach Activities: Hosted interagency tours of base operations and research aircraft	McClellan, CA and Honolulu, HI	1/15 - 2/24/2015
Ryan Spackman	Internal	All-Hands Briefings at NOAA Aircraft Operations Center	MacDill AFB, Tampa, FL	4/2014, 1/2015
Ryan Spackman	Resource	CalWater website, public relations handouts, science plan, and GEWEX newsletter article	Boulder, CO	7/2011 - 2/2015
De-Zheng Sun	Media	Interview by AGU on Monograph "Climate Dynamics: Why Does change?"	AGU/EOS	
Allen White	Outreach	SOS demonstration on atmospheric rivers	AMS Annual Mtg., Phoenix, AZ	1/1/2015
Allen White	Training	HMT-SEPS Observations and Forecast Utility Briefing and Discussion	NOAA, Boulder, CO	11/15/2013
Allen White	Media	CalWater 2015 Media Coverage	Sacramento, CA and NOAA, Boulder, CO	Jan-Feb 2015
Allen White	Internal	PSD Seminar: NOAA's Rapid Response to the Howard A. Hanson Dam Flood Risk Management Crisis	NOAA, Boulder, CO	4/25/2012
Allen White	Resource	HMT News contributions	NOAA, Boulder, CO	Ongoing
Gary Wick	Media	HS3 Media Day	Wallops, VA	Sep 2013
Gary Wick	Internal	NOAA Science Days (w/ Robbie Hood)	NOAA	May 2013

Name	Type	Activity/Title/Name	Outlet/Location	Date
James Wilczak	Public Outreach	Public Lecture	Chautauqua Science Series, Boulder, CO	3/5/2013
Daniel Wolfe	Outreach	Science and Filmmaking Outreach with Earth Explorers	Boulder, CO Westview Middle School	Feb-May 2014
Daniel Wolfe	Outreach	Guest lecture	University of Colorado, CIRES	3/4/2013
Daniel Wolfe	Outreach	Elementary school science fair - judge	Peak Charter School	5/1/2014
Daniel Wolfe	Outreach	Elementary school science fair - judge	Little Elementary Arvada, CO	4/16/2015
Daniel Wolfe	PSD talk	BAO: More Than Just a Tall Tower	DSRC Boulder, CO	6/26/2013
Valery Zavorotny	Outreach	Elementary school learning fair - judge	Ryan Elementary, Lafayette, CO	3/1/2013

N. Web Statistics



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PSD Web and FTP Traffic

PSD maintains an active Web presence, and provides dataset access via FTP, THREDDS and openDAP.

Services provided include:

- **Data Access:** Access to datasets including reanalyses, reforecast, Arctic observatories, AR observations, cruise, and satellite.
- **Data Analysis:** Online tools allow plotting, analysis and comparison of available datasets.
- **Forecast Products:** Access to experimental forecast products, including SST, winds, tropical atmosphere, hurricanes, decadal temperature.
- **Pre-Generated Climate/Weather Products:** Including our Maproom, Atmospheric River animations, BAO Tower Observatory.
- **Field Project Sites:** Access to data from a variety of field projects, including CalWater, WFIP, HMT Testbed, Texas Air Quality Study 2006.
- **Research Products:** Specialized products such as MJO indices, Climate Assessment Reports.

WEB VISITORS – COUNTRY OF ORIGIN

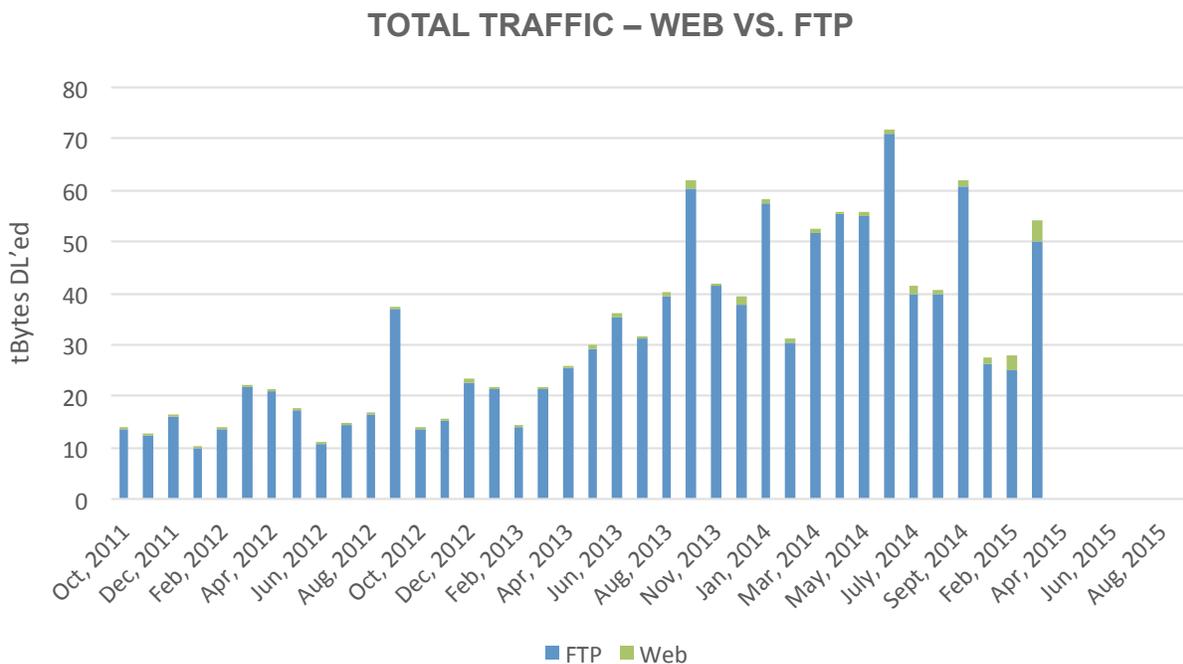
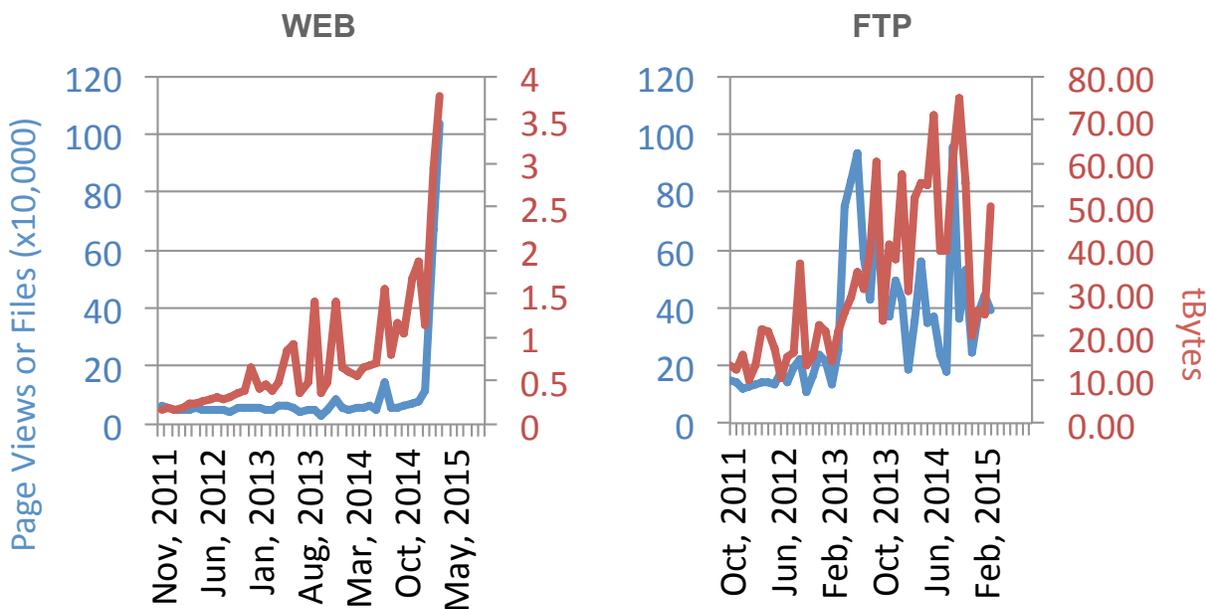


PSD Web visits – FY 2012-15

PSD's web presence is global, with page views from 225 countries, virtually every major country. Significant audiences include Australia, Canada, China, France, Germany, India, Japan, Mexico, Spain, the UK, and the USA.

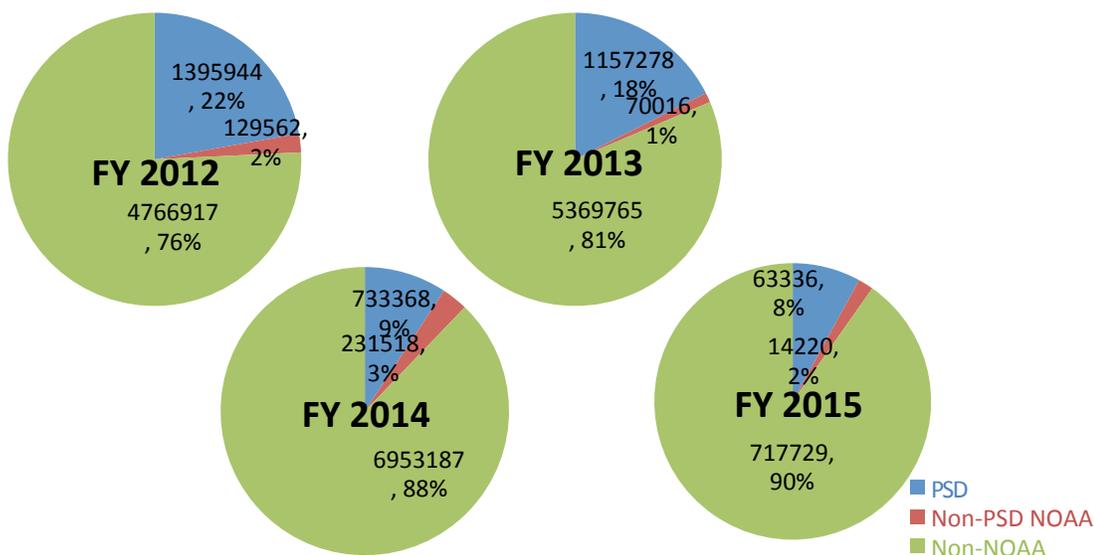
Total Traffic

- PSD’s Web & FTP Traffic has continued to increase over the past 4 years
- Close to 8 million web page views, nearly 50 million file downloads for FY14.
- 4.3 million plots produced over the last year.



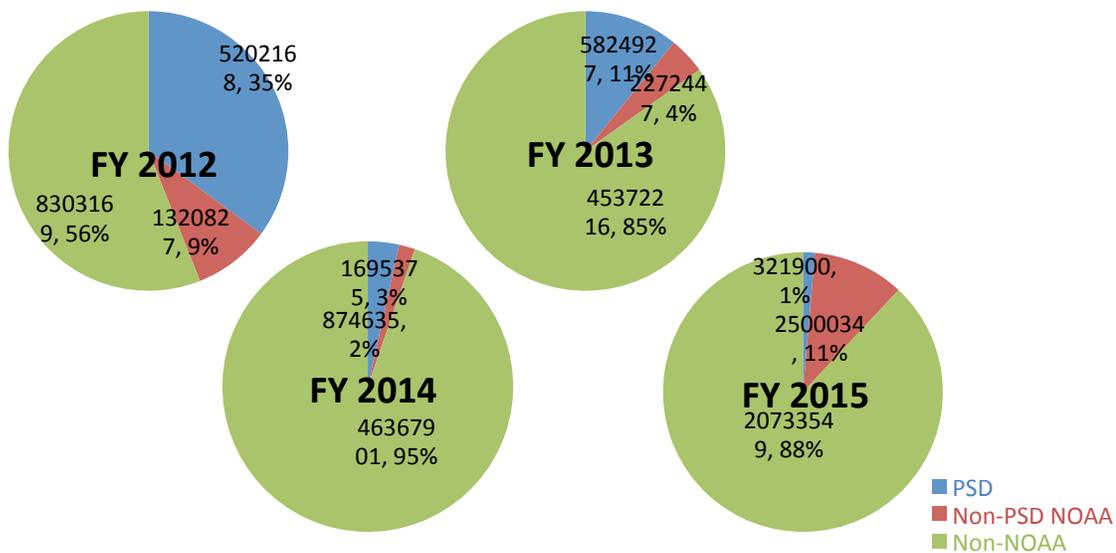
FTP continues to constitute the bulk of the data traffic, although web-based protocols are increasing in importance.

WEB VISITOR BREAKDOWN BY ORGANIZATION (PAGE VIEWS)



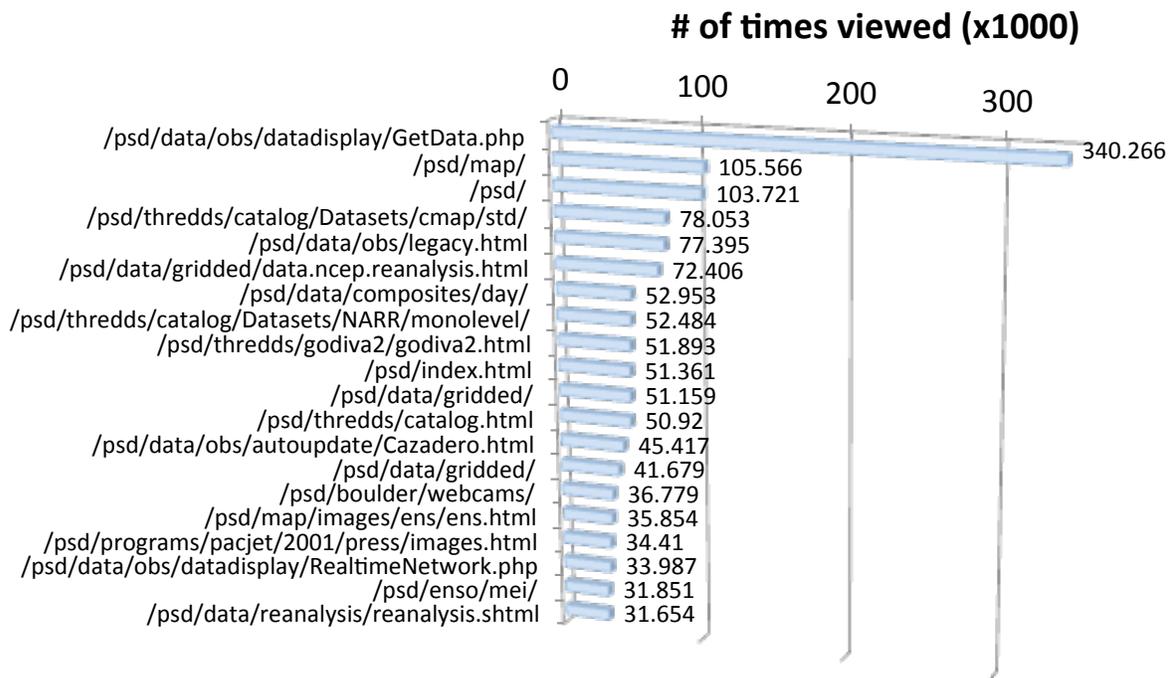
The majority of PSD’s web visitors are from outside of NOAA. That fraction has been increasing of the past 4 years.

FTP VISITOR BREAKDOWN BY ORGANIZATION (FILE DOWNLOADS)

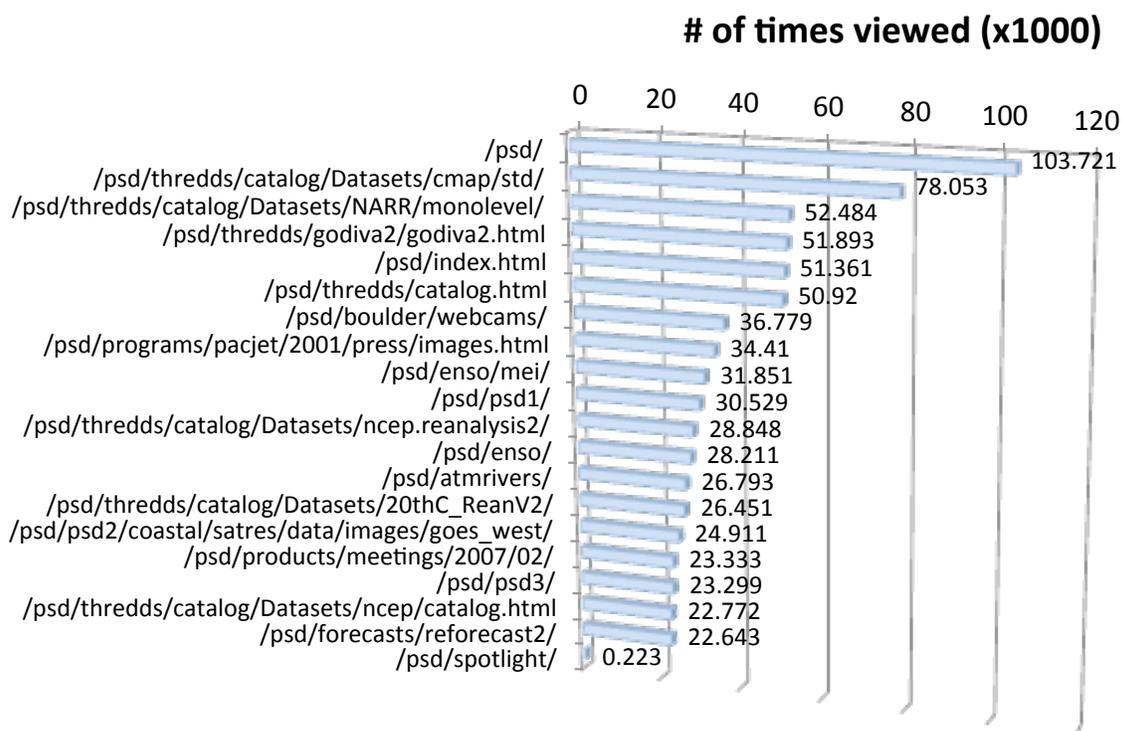


The majority of PSD’s FTP downloads are also from outside of NOAA.

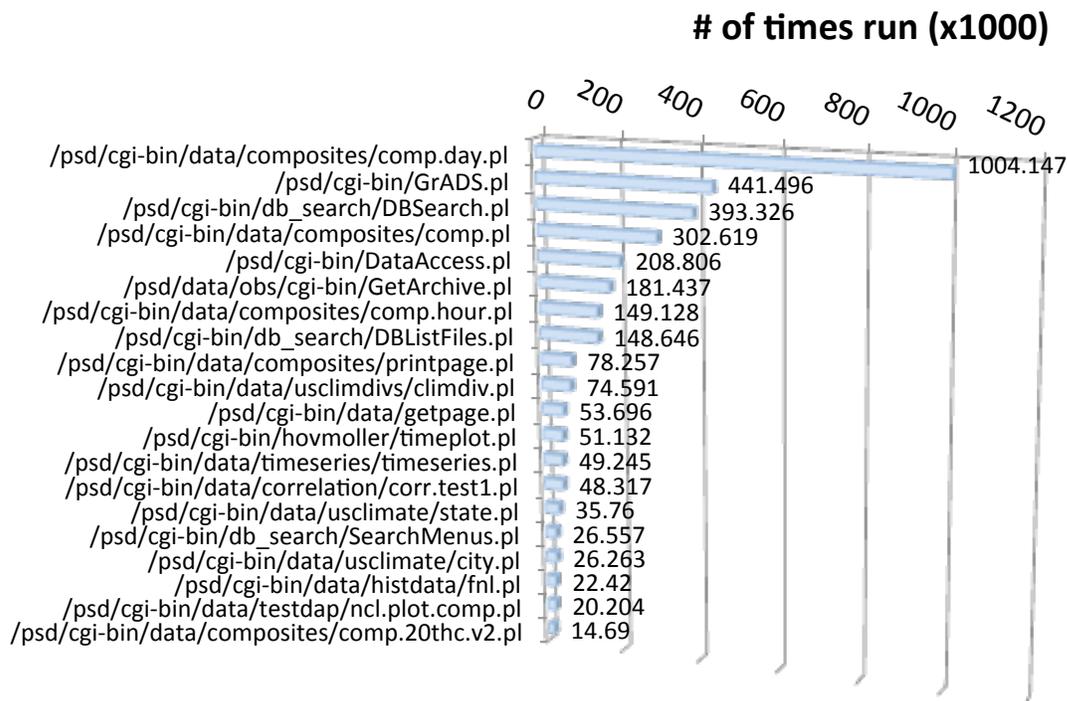
TOP 20 WEB PAGES – FYTD



TOP 20 NON-DATA WEB PAGES – FYTD



TOP 20 WEB SCRIPTS – FYTD



Selected Kudos

I just wanted to provide a quick note on the usefulness of the Daily Mean Composites (...) page that you provide through your web site. What an awesome tool! (...) "Job well done!" (Mike Huston, NWS Pocatello, 2011)

I use this page to make monthly, yearly and water year composites for presentations to a number of water resource groups. I also use this for monthly internal reports. (Aldis Strautins. Service Hydrologist NWS GJ, 2015)

I use your pages in support of classroom instruction and for student projects (...) Bottom line: Great resource! (Lance Bosart, Professor, U of Albany, 2012)

No other website widely available is as good as the one you maintain there at NOAA. To lose it would be a big blow to energy meteorologists around the world (Jess Torpey Senior Meteorologist, E.ON Global Commodities Düsseldorf, Germany, 2014)

This online tool is fantastic! I am a PhD student at the University of Alaska Fairbanks, and this resource is an amazing way to show synoptic overviews for the case study days in my research without laborious data manipulations. (Derek Starkenburg, University of Alaska Fairbanks student, 2014)

I have used ESRL PSD online plotting and analysis tool extensively. This tool is of great help and highly time saving one. The way you have created and designed it is simply superb. It gives access to huge

and diverse amount of data without actually downloading it. (Chinmay Khadke Research Fellow India Meteorological Department Pune, India, 2013).

We used the Monthly/Seasonal Climate Composites page in my Biogeochemical Cycles class today (taught by Dr. Oliver Wingenter), to model the Pacific Decadal Oscillation. Being able to visualize T, P and wind speed variations associated with phase changes in PDO was a great help. (Annie Riggins Kottowski Graduate Fellow NM Institute of Mining and Technology 2014)

Glossary

Web traffic – Network traffic (viewing of html pages, file downloads, running scripts, etc) associated with the HTTP or HTTPS (Hypertext Transfer Protocol, or Hypertext Transfer Secure Protocol). Http(s) is the protocol of web browsers and typically was it used to view web pages. It can also be used to download files although for this purpose FTP is much more robust and efficient.

FTP traffic – Network traffic (file downloads) associated with the FTP (File Transfer Protocol) – a standard network protocol often used to transfer files from one host to another over the Internet.

Web Page – A web page consists of single URL a visitor might bookmark and all the associated elements (images, sub-parts, etc) that might be download by the visitor in the course of viewing the page. A web page often consists of multiple elements each of which must be retrieved by the visitor's browser.

Non-Data Web Page – a web page in the PSD hierarchy that does not have /psd/data/ or /psd/map in the URL.

Scripts – defined as a url that has *.pl in it. Typically, a program or other action that a visitor causes to happen on our server by accessing a web page, or clicking on a “submit” button on one of our pages. The action involved might generate an image, provide a specific subset of a data page, or accomplish a number of other things for that visitor on our web server.

Page Views – a page view consists of single visitor accessing a page on the PSD website and retrieving all the associated elements. Each element thus retrieved consists of a “hit” on the website.

gBytes - in reference to web traffic, the total amount of data downloaded by visitors to our site over a given period. This may include web pages and associated elements, data generated by running scripts, or downloading data files via the web browser directly.

Hits – any request to the web server from a visitors web browser. This might include accessing a page and each of its associated elements (each access is a hit), running a script, or accessing a specific data file. Viewing a single web page may involve tens, if not hundreds, of hits, depending upon the complexity of the page.

Technical Notes & Caveats

- Information for countries comes from a lookup against the GeoIP database from MaxMind.
- Top Level domains are determined by doing nslookups on the IP addresses.
- A Page View is defined as a log entry that had a result of 200 or 304 and had `*.htm*` in the URL or the URL ends in a `/`.
- A Non Data Page is a Page View that does not have `/psd/data*` or `/psd/map*` in the URL.
- A Script is defined as having `*.pl` in the URL. Note: all our scripts are perl.
- A Hit is defined as any log entry with a status of 200 or 304.
- PSD is defined as domain matching `*psd*.noaa.gov`
- NOAA is defined as domain matching `*noaa.gov`
- A Visitor is defined as a unique IP Address within the time period. This number is approximate because of proxies and firewalls. As multiple visitors may come from a single IP.
- A Page Visitor is a Visitor who viewed a Page.
- Robot hits are not counted in the statistics.

NOTES ON URL COUNTS:

- `/boulder/index.html` and `/boulder` are the identical page. Same for `/psd/` and `/psd/index.html`.
- All the `/obs/img/` are navigation images and while they should be counted overall, they probably shouldn't be listed in top 20/other hits